# The Chemical Age

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# Lubricants

THE advances that are being made in the petroleum industry are exceedingly rapid, often too rapid, for those outside the industry to follow. This industry has in the past been most prodigal of its resources; oil has been allowed to be wasted and many of the products that are now used were regarded as of little value. This is almost bound to happen in any new industry. The need for conservation, however, is making the work of the chemist of ever-increasing importance in the oil-fields. The problem of the working-up of the permanent gases is now exercising the industry and is being solved as was shown in the recent paper by Dr. Dunstan before the Institute of Fuel. The ever-increasing demands of engineers upon the oil industry for better and better products to meet more drastic treatment is also keeping the chemist busy, and it is safe to say that few, if any, other industries have to be so keenly alive to the needs of the engineers and designers to-day as the oil industry. In the comparatively short space of 20 years, petrol as sold to the motorist has changed almost out of recognition. If that petrol were used in the engine of to-day, says the Institute of Petroleum Knock-rating Committee, "it would not be possible to open the throttle without violent knocking, and in addition to the unpleasant noise, rapid over-heating would result, together with destruction of the sparking plugs and probably pre-ignition so violent as to damage the engine. In addition the volatility characteristics of the fuels of those days were so variable that carburation difficulties would be likely to give rise to troubles only one degree less serious than those due to knocking."

The production of lubricants to meet the more rigid demands of the engineer is an equally difficult problem. In chemical engineering, the chemist desirous of working at higher temperatures and pressures makes demands upon the engineer and metallurgist for metals and designs to fulfil ever more drastic conditions. The automobile engineer upholds the claims of the engineer by making demands upon the chemist. Perusal of the papers read before the Summer Meeting of the Institute of Petroleum suggests that not the least difficulty in meeting this demand is that of finding a method of testing new or improved engine lubricants to discover how far the efforts of the chemist have met with success. Many laboratory tests are available, but apparently without having much real value because the deterioration of the oil in the laboratory and that occurring in the internal combustion engine are of a different nature. The deterioration processes in the engine are of a very complicated character, particularly those resulting from the formation of carbon deposits which depend so much upon engine conditions, especially temperature. Amongst these processes are oxidation, polymerisation, and carbonisation and their absolute and relative intensity may be different according to the conditions in the engine so that there may be changes from one process to another. This difficulty is not unexpected in view of the complex nature of lubricating oils. A lubricant is probably a two-phase colloidal system in which one phase is a highly complicated compound of molecules of high molecular weight dispersed to a greater or less extent in some similar hydrocarbon medium. If one accepts the conception of a lubricant as a colloidal system which is partly adsorbed on the bearing surface, it follows that the nature of the bearing surface may be equally as important as the lubricant and that the lubricant must have an extremely high molecular weight. The building up of these very heavy molecules is one of the difficulties of the chemist's work.

The difficulties of laboratory testing do not seem to be resolvable by the installation of specially designed testing machines, such as the Timken, Cornell and Four-ball machines, because there is what is described in one paper as a "well-known lack of agreement between the results." Bearing in mind the numerous uses to which lubricants are put, the varied conditions of service, and the multiplicity of properties which they must possess, it will be readily understood that this problem is one of extreme complexity. For example, in the same engine and under the same test conditions the same oils may show a certain rating for one spot in the engine and quite another rating for a different spot. Lubricants intended for use in large engines, for example aviation oils, cannot therefore be tested in smaller engines because there is no guarantee that the results upon the small engines will be applicable to the actual engines in practice. The papers read on this subject before the Summer Meeting of the Institute of Petroleum focused attention upon these difficulties but it does not yet appear that they are on the way to a generally agreed solution.

*Timorous precautions and petty prudences help to bring trade to a standstill, weaken our economic position and make more likely that very danger we are trying to prevent.*

—*The Rt. Hon. Oliver Stanley.*

# NOTES AND COMMENTS

### Exemption of Young Chemists from National Service

WE publish on page 393 extracts from a letter from Dr. Herbert Levinstein published in *The Times,* in which he puts forward an objection to the inclusion of chemists of 21 in the revised schedule of reserved occupations. Few will disagree with his opinion, nor are there any tenable reasons for disagreement, that young men of 21, even if they have taken an honours degree in chemistry by that age, enter industry as learners. It is absurd to suggest that they are indispensable to chemical industry and are in any way " key " men. Dr. Levinstein shows that the exemption of chemical engineers at 21 is still more absurd. The Institution of Chemical Engineers, the qualifying body for chemical engineers, does not admit young men under 25 for the reason that the necessary minimum training and experience cannot be acquired under that age. There is, in short, no such thing as a qualified chemical engineer less than 25 years of age. From this point of view, Dr. Levinstein's argument that the inclusion of chemists and " chemical engineers " in the schedule thus creates a dangerous class distinction, is an irrefutable one. But the whole question is complicated and bristles with debatable issues. For example, from another point of view a strong case can be made out for retaining the chemist of 21 in the schedule of reserved occupations. In the last war, according to figures quoted in *The Times,* the chemical and explosives industry lost no less than 23.8 per cent. of their employees in less than a year (between August, 1914 and July, 1915). No doubt a large proportion of this percentage was made up of young chemists who, although they could not be regarded as indispensable to the industry at the time, were sadly missed in the later stages of the war and in the post-war re-establishment of the industry. The chemical industry is basic to so many of the country's manufactures and is so decisive a factor in determining the national prosperity that it would be folly to repeat the errors of 1914 and throw away its future leaders.

### Test for Toxicity of Wood Preservatives

IN the past many methods have been tried for determining the fungicidal toxicity of wood preservatives and in recent years efforts have been made both in America and this country to standardise tests. In America the so-called agar or Petri dish method has been used largely and a standard technique for carrying out this test has been proposed. In Europe, particularly in Germany, the wood-block method has been preferred, and a committee set up by an International Conference held in Berlin in 1930 has recently published a detailed description of a standardised method for carrying out fungicidal toxicity tests on wood preservatives by this method. The conclusions of the Berlin conference were that the wood-block method should be considered as the most suitable means for estimating the toxicity of a wood preservative to fungi. This method is recommended for adoption as the British Standard method, which has just been published by the British Standards Institution (B.S.S. 838-1939). The efficiency of any substance for the preservation of wood depends on a number of factors, the most important of which are: Toxicity or killing power towards wood-destroying fungi; penetrating power; and permanence, i.e., resistance to leaching, evaporation and chemical decomposition. In the present specification, only tests for the toxicity of wood preservatives to fungi are considered. Emphasis is laid on the fact that it is not possible to estimate from these alone, the exact value in practice of any substance as a wood preservative, particularly if this is to be used on timber which is to be exposed out-of-doors to the influence of the weather. It is further emphasised that the values given by the specified technique can be applicable in practice only if the technical method of impregnation of the wood and the amount of preservative absorbed under practical conditions are comparable with those specified in the laboratory tests. The resistance to weathering is also an important factor in judging a wood preservative. Additional tests to determine the other important qualities of wood preservatives, such as penetrating power and permanence, are being developed and it is hoped that at a later date it may be possible to standardise the methods of carrying out the tests.

### Reduction in Atmospheric Pollution

THE report for the year ended March 31, 1938, of the Atmospheric Pollution Research Committee, appointed to give the D.S.I.R. expert advice in its work of co-ordinating local observations of atmospheric pollution and for carrying out research into the nature of the pollution and the best methods of measurements, was published this week. A slow improvement in the state of the atmosphere can be concluded from the report. Thus, a comparison of the figures obtained with deposit gauges for the year under review with the average deposit for the five years ended 1932 shows that, in the case of tar, 57 per cent. of the stations where such a comparison is possible have a marked reduction in the deposit, while 30 per cent. show an increase. Taking the figures for the deposit of total solids, 55 per cent. of the stations show a marked decrease, while only 9 per cent., a marked increase. While the figures for 1937-1938 are rather better than the similar figures for the preceding two years, the report points out that the results are affected by rainfall which was below the average in 1937-1938. Since its inception in 1927, the investigation of the committee has produced and is continuing to produce a mass of data about the facts of atmospheric pollution, " on which," the report states, " those whose responsibility it is to consider and to deal with the problem of smoke nuisance may base well-founded proposals for action in the administrative sphere."

### Trade Marks and Export Trade

IN an address on Tuesday to the Royal Empire Society on trade marks and their importance in export trade, Major J. N. Evans-Jackson had some useful things to say on the different principles governing the use and registration of trade marks in the principal overseas countries. He particularly contrasted those countries in which the first user of a mark is entitled to it and those countries in which the first person to register a mark obtains exclusive rights over a person who may have used the mark previously for many years, without obtaining registration. He also mentioned that there are still some important markets in which no provision for the registration of trade marks exist and where it is necessary to resort to the cumbersome and lengthy procedure of a passing-off action to restrain infringement. Attention was drawn to the differences in the laws of various countries relating to the assignment of trade marks and the granting of licences to use trade marks. Mr. Evans-Jackson pointed out that in some countries a trade mark may be assigned only with the goodwill of the business in connection with

which it is used, while in others a trade mark may be assigned without goodwill. The laws of some countries permit the proprietor of a mark to license another person to use his trade mark whereas in the case of other countries a trade mark may become invalid by the grant of a licence. It was pointed out that in this country the licensing of a trade mark and the assignment of a trade mark without goodwill were contrary to law until the 1938 Trade Marks Act came into force, under which it is now possible to assign a trade mark either with or without goodwill and, while indiscriminate licensing is not permitted, the registered proprietor of a mark may now apply to register another person as a registered user of his mark, and, subject to the Registrar of Trade Marks' approval, such other person may be granted the right to use the Mark. There is a danger that British firms may assume that because some other firm has been registered as a user in Great Britain that that person is also entitled to use his mark in the export market or, that a mark registered abroad may be assigned without goodwill, which is not at present the case in some markets. Therefore it behoves registered users and assignees without goodwill to make certain of the position in overseas countries before taking such a mark into use in those countries, otherwise they may find the mark invalidated.

### A Water Exhibition

THE Liege International Water Exhibition which was officially opened last Saturday, has been organised to celebrate the approaching completion of the 100-mile Albert Canal which is being constructed (at a cost of £15 millions) to make Liege an inland seaport. The theme of the exhibition is water and its uses in all spheres of human activity, one section being devoted to water purification. The U.S.A. and Great Britain are the only great powers which are not participating officially (although a number of British firms are exhibiting individually). Several congresses relating to chemistry are scheduled to take place during the run of the Exhibition, which terminates in November. They are as follows: October 13, 14 and 15, 7th International Congress of Biological Chemistry (organised by the Biological Society of Paris). October 14 and 15, Pharmaceutical Days (organised by M. J. Jaspar, 2, Rue du Gouvernement, Provisoire, Brussels). and Congress of the Chemical Society of Belgium (organised by Professor Schoofs, 41, Rue Louvrex, Liege).

### Trade and Transfers

AS currency control, barter and similar devices have become the normal order in many markets, the business community has ceased to be surprised at new developments of this kind. There are, however, amusing possibilities in the report from Rio de Janeiro that a transfer fee of 416 bags of coffee is to be paid by a Brazilian football club for a Uruguayan "outside right" who is at present playing in Italy. It is, of course, well known that Brazil has more coffee than she can dispose of, while the other day a Fascist spokesman asserted that it was "unpatriotic" for Italians to drink imported coffee. The footballer will hardly feel flattered at being exchanged for groceries, but he may find consolation in knowing that some worthy citizens of Genoa will be able to indulge in the finishing touch to a good dinner, without a sense of guilt! And perhaps Mr. George Allison will now offer a shipload of sugar to put in the coffee should he feel tempted to go one better on behalf of the Arsenal. Attempts to promote Fascism in Brazil are officially denied, but would this transfer have gone through so smoothly had an outside *left* been involved?

## Chemical Matters in Parliament

### Hydrocarbon Oils

Major Procter asked the Financial Secretary to the Treasury in the House of Commons on Monday whether he would state the quantities of each of the categories of hydrocarbon oils retained for home consumption during the year ended March 31, 1939; and what were the net receipts of duty in respect thereof?

Captain Crookshank replied: The quantities of each category of hydrocarbon oils retained for home consumption during the year ended March 31, 1939, and the respective net receipts of duty, were approximately as follows:

| | Quantity retained for Home Consumption Gallons | Net Receipts £ |
|---|---|---|
| Light Oils: | | |
| Petroleum Spirit: | | |
| Motor Spirit | 1,359,534,000 | 50,548,000 |
| Other Spirit | 24,508,000 | 915,000 |
| Coal Tar Products: | | |
| Benzol | 4,019,000 | 149,000 |
| Other Sorts | — | — |
| Turpentine | 4,781,000 | 179,000 |
| Heavy oils for mixing with light oils | 6,000 | — |
| Other Hydrocarbon Oils | 20,000 | 1,000 |
| Oils in Composite Articles | 175,000 | 6,000 |
| Total | 1,393,043,000 | 51,798,000 |
| *Deduct* Net Amount paid to Isle of Man* | | 66,000 |
| Net Receipts | | 51,732,000 |
| Heavy Oils: | | |
| Petroleum Oil: | | |
| Road Fuel Oil | 92,054,000 | 3,427,000 |
| Other Fuel Oil | 278,491,000 | 1,160,000 |
| Crude Oil | 2,690,000 | 11,000 |
| Kerosene | 203,440,000 | 847,000 |
| Lubricating Oil | 102,897,000 | 429,000 |
| Gas Oil | 70,765,000 | 295,000 |
| Other Sorts | 3,293,000 | 14,000 |
| Coal Tar Products | 43,000 | — |
| Other Oils | 195,000 | 1,000 |
| Oil in Composite Articles | 386,000 | 2,000 |
| Total | 754,254,000 | 6,186,000 |
| Grand Total | | 57,918,000 |

* Estimated difference between amounts collected in, and allocated to, the Isle of Man.

Mr. R. Morgan asked the Chancellor of the Exchequer whether he would state the cost of the allowance of 8¾d. per

### Power and Industrial Alcohol

absolute gallon paid on power and industrial alcohol, respectively, during the financial years ended March 31, 1938, and 1939, respectively.

Sir J. Simon: Following is the answer:

| Financial Year ended. | Total amounts paid (at the rate of 5d. per proof gallon) in respect of. Spirits used in the manufacture of Power Methylated Spirits. | Spirits used in the manufacture of Industrial Methylated Spirits or received for use in arts and manufactures (Finance Act 1902, Section 8). |
|---|---|---|
| | £ | £ |
| 31st March, 1938. | 222,000 | 711,000 |
| 31st March, 1939. | 241,000 | 664,000 |

MANUFACTURE of starch from maize on an experimental scale has already been undertaken by a private concern at Cawnpore, India, researches carried out at the Government Harcourt Butler Technological Institute, Cawnpore, having shown the possibility of starting such manufacture as a large scale industry.

# Testing Lubricants

## Standardisation of Methods—Characteristics of Suitable Lubricants—Papers Presented at Institute of Petroleum Summer Meeting

SEVERAL of the papers presented for discussion at the summer meeting of the Institute of Petroleum, held at Birmingham from Monday to Wednesday, were concerned with the subject of testing lubricants. In a paper on "Practical Methods of Testing Lubricants," Mr. J. H. Evans (British Timken, Ltd.) said: The efficient lubrication of anti-friction bearings may be effected by any of the following types of lubricant: 1. Lime-soap grease. 2. Soda-soap grease. 3. Mixed-base grease. 4. Aluminium stearate. 5. Mineral oils of varying degrees of refinement from light to heavy cylinder stock. 6. Lead soap and extreme pressure-type oils and greases. Of these, lime- and soda-soap greases are the most widely used, and between them probably account for over 95 per cent. of the grease-lubricated applications.

### Soda-soap Greases Widely Used

It was mainly on account of the instability of lime-soap greases that soda-soap greases became so widely used. Another factor in favour of soda-soap greases was their long, stringy, fibrous texture, as this formed an additional seal and prevented the separated oil from leaving the enclosures.

Soda-base greases, however, are easily washed out of the enclosures by excess of water, leaving the highly ground bearing-elements unprotected and free to corrode. In addition, many of these fibrous greases channelled badly in cold weather; consequently the bearings, operating without adequate lubrication, soon overheated, and in many cases seizure of the component parts resulted.

These conditions did not exist where a good-quality lime-soap grease had been used, and the co-operation of the grease-makers was sought to improve, and eventually standardise on greases of this type.

In accordance with this procedure, it soon became apparent that specifications and standardised testing methods were both desirable and necessary if the maximum benefits were to be obtained.

Lime-soap greases showed considerable variation in consistency, and it was felt that this characteristic should be the first to receive attention. Unfortunately there was no universal standard method for checking this property, and after careful consideration it was decided to adopt the same method as that employed by the American company associated with British Timken, Ltd., namely, the Karns Maag consistometer.

The consistometer is made up of an alloy 6 in. × 9 in., with a centring device for the grease-cup, and an upright 16½ in. high, to which is attached a projection for a release device. A metal ball is held in place by this arrangement 12 in. above the surface of the grease, and can be released by pressing a trigger. The cup is filled with grease, levelled and heated to 75° F. for 1 hour, centred, and the ball is then allowed to fall freely into it. The depth of penetration is measured in millimetres direct from the rule attached to the saddle-gauge.

### A Simple Consistometer

A much simpler device giving concordant results with the Karns Maag was later suggested by E. A. Evans, of Messrs. Wakefields. It consists of a piece of ordinary burette tubing with a mark inscribed 12 in. from the bottom. A millimetre paper scale 100 mm. long is attached to the bottom of the tube. The plunger is an aluminium alloy rod 100 mm. long, and it is allowed to fall freely down the tube from the inscribed mark into the levelled sample of grease. The depth of penetration is read off direct in millimetres from the top edge of the plunger to the millimetre scale.

Standardisation of the method for determining moisture next received attention. Originally it was contended that at least 2 per cent. water was necessary to ensure complete hydration of the lime, but, as assumption yielded to experiment, it was soon found that by using correctly hydrated lime it was possible to manufacture grease in bulk with a water content of less than 1 per cent. This figure was therefore fixed as a maximum. The method fixed for determining the moisture was the Dean and Stark distillation method using gasoline as solvent.

Ash content was fixed at 2 per cent. maximum calculated as oxide.

The question of separation of mineral oil on standing and heating had still to be considered, as although great improvement in the quality of the grease had resulted from controlling the properties already mentioned, separation of oil from the soaps sometimes occurred.

Eventually the following method for estimating the separated oil was evolved: 25 gms. of grease are placed in the standard Pensky-Martin flash-point cup and heated at the rate of 10° F. per minute to 250° F. The grease is maintained at this temperature for half an hour. During heating and maintaining the grease is stirred at the rate of 2 revolutions per second for alternate minutes. It is then poured into a silica tube approximately 3 in. long by 1 in. inside diameter, one end of which is sealed with a cork. After half an hour atmospheric cooling the cork is removed and the grease, supported by two pieces of flattened wire $\frac{1}{16}$ in. wide, wound vertically round the tube, is suspended over a conical measure graduated in c.c.s. No separation of mineral oil is allowed after 48 hours cooling.

Melting-point determinations are made by the Ubbelohde method, in which the drop point is recorded. A minimum temperature of 210° F. was fixed.

### Acidity or Alkalinity

It has been established that free fatty acid—calculated as oleic—up to 0.5 per cent. has no injurious effect on anti-friction bearings. Most lime-soap greases are, however, slightly alkaline, and alkalinity up to 0.14 per cent. CaO is approved.

Corrosion tests in which copper and steel plates are submerged in the grease for 48 hours at atmospheric temperature should show no pitting or corroding.

Useful information can often be obtained by studying the behaviour of the grease when submitted to a heat-stability test. A recommended test is similar to the separation test already described, except that half of the grease is poured on to a cold watch-glass direct from 250° F. The other half is heated up to the fire-point of the base oil, and then also poured on to a cold watch-glass. If the greases show any oil separation, appreciable hardening or softening from 250° F., they are rejected, while it is found that most greases submitted to the fire-point test show no oil separation, but appreciable hardening. Little work is necessary to bring these back to perfect good lubricants.

Lime-greases are also checked for emulsion-forming properties by shaking up with hot and cold water. Greases showing any emulsification are rejected.

The mineral oil is extracted and its physical characteristics are determined. The most satisfactory type of base is a well-refined mineral oil having a minimum viscosity of 420 seconds Redwood at 100° F. Open-flash, min. 340° F. Fire point, min. 380. Cold pour, max. 40° F.

With the advent of these new non-separating lime-base greases, it was found that for practically all automotive, locomotive, and many industrial applications, only one grade of grease was required. This is a smooth, well-milled pro-

duct composed of high-grade soap and a refined filtered mineral oil of the viscosity mentioned above. The grease must be free from fillers of all kinds.

Greases compounded from mineral oil and soda soaps are recommended for applications where the operating temperatures are high and enclosures imperfect.

The type of soda-soap grease found most suitable has the following characteristics: Consistency, 15-25 Karns Maag.; moisture, max. 0.3 per cent.; melting point, min. 300° F.; soda soap, 15-18 per cent.; and viscosity at 100° F., approx. 420 secs. Redwood.

Other properties, with the exception of emulsification, are similar to lime-soap greases. The grease must be a smooth, cold-milled product of short-fibre texture and free from all fillers.

Frequently 3-5 per cent. of lime soap is added to soda-soap greases to improve the appearance of the grease and give it a smooth, butter, non-grainy texture similar to that of lime-base grease.

These products are stable, and have melting points intermediate between lime- and soda-soap greases. They are best compounded from Pennsylvania pale oil of approximately 300 secs. Redwood viscosity at 100° F. Melting points are generally in the region of 150° C.

Sometimes small percentages of aluminium stearate are added to lime-soap greases to improve heat stability.

## Aluminium Stearate Greases

Aluminium stearate greases are generally used for aircraft rocker-arm bearings and variable-pitch propellers. Samples recently examined had the following physical properties: Moisture, 0.1-0.3; ash, 0.8-1.0; aluminium soap, 15-18 per cent.; melting point, 212° F.; separation, nil; emulsification, nil; alkalinity, neutral; open flash, 515° F.; fire, 575° F.; consistency, 35 mm. Karns Maag—others too thin; and mineral-oil base, viscosity at 210° F. 150 Redwood secs.

In estimating the aluminium it is generally sufficiently accurate to dissolve the ash in boiling water, filter, burn, and weigh as $Al_2O_3$, ignoring any trace of iron which may be present.

The advantages claimed for aluminium-stearate greases over other types may not be justified, although they are generally accepted. Among them are the following: Melting point intermediate between lime- and soda-soap greases; water repellant—similar to lime-soap grease: become more adhesive and cohesive on heating to near the melting point, whereas lime- and soda-soap greases tend to thin down considerably on heating: heat stable—they can be heated above the melting point, and return to their original consistency on cooling—in this respect they resemble modern lime-soap greases.

Many of these properties can be checked, but it is also advisable to test the corrosive effect of aluminium-stearate greases on copper and steel test-pieces. This has been found necessary as some aluminium stearates contain appreciable quantities of stearic acid. A method used to accelerate the corrosive action of these or any lubricant is to submerge the test-plates in the lubricant and heat to a temperature of 210° F. for several hours. This method often shows corrosion when it is not obvious on samples tested at ordinary atmospheric temperature.

There appears to be some difficulty in controlling the consistency of aluminium-stearate greases, and as this is partly a function of the speed of cooling during manufacture, careful control in production is necessary.

There is sometimes a tendency for these greases to thin down in storage, but on heating to their melting point they return to their original consistency.

The use of fillers such as talc, graphite, waxes, rosin, clay, or mica, is not recommended in any greases intended for use with anti-friction bearings, as they not only lap the components in, but continue wearing them away, causing frequent replacements.

The tests on the consistency of the various greases at increasing temperatures are most illuminating, as so much has been written on the advantages of soda-soap greases when running temperatures are high. The soda-soap greases examined were grades universally recommended for the lubrication of anti-friction bearings, and the experiments show them to thin down more quickly on heating than lime-soap greases. The general softening range appears to lie between 140° and 160° F. and even though the melting points—as determined on new grease by the Ubbelohde method—are so much higher than the lime-soap greases, they thin down between these temperatures to such an extent that only very efficient enclosures could retain them.

The lime-soap greases soften gradually, and are more viscous at the higher temperatures.

## Running Tests

Results of running tests confirm the consistency tests—*i.e.*, in practically every case the grease thins down between the rolling elements at a temperature of 140-180° F., irrespective of the type of grease used. Lime-soap greases softened gradually without tracking, and eventually flowed through the bearings in a similar manner to oil giving equivalent lubrication.

Before leaving the question of greases for ordinary applications, it is interesting to note that experiments are being made in America with barium-soap grease. These greases are water-repellant, have a melting point of over 300° F., and are similar in consistency and texture to lime-soap greases. It is expected that these greases, when fully developed, will prove an ideal lubricant for anti-friction bearings, as they possess the best properties without the respective disadvantages of soda- and lime-soap greases.

No special tests are necessary when checking mineral or compounded oils. Experience proves that the lubricants used, under normal loading conditions, are entirely satisfactory for the lubrication of anti-friction bearings. The viscosity range of oils found satisfactory in service varies between 60 and 170 secs. Redwood at 210° F., depending on the size, load, and speed of the application.

No discussion on the testing of extreme-pressure lubricants could be complete without mention being made of the Timken Wear and Lubricant Testing Machine. This machine was specially designed to measure the load-carrying capacity of lubricants, both oils and greases, when loaded near to their boundary film strength. A lubricant tester, developed in the laboratories of the Timken Roller Bearing Co. provides accurate information on the load-carrying capacity of lubricants, on the measurement of friction, and, in a simple accurate manner, on the wear characteristics of any kind of material.

## Mineral Oils

It has been demonstrated by Maag that the film strength of a straight uncompounded mineral oil is directly related to the viscosity. The effect of additions of various metallic soaps and esters on the film strength of a mineral oil of 125 secs. Redwood at 140° F. were investigated by E. A. Evans; using the Almen machine.

Experiments on the Timken machine to check these results using the same viscosity mineral oil with similar additions gave results which confirm those obtained by Evans, in so much as they prove the esters have more effect on the film strength than the metallic soaps. But even the esters do not increase the film strength sufficiently for them to be considered extreme pressure lubricants.

It has been shown that film strength is a function of the viscosity of straight mineral oil; when an E.-P. base is added to the oil, however, viscosity is of secondary importance.

Extreme-pressure oils were primarily developed for the lubrication of hypoid gears, and although the use of such gears is not general in this country, there are indications that in the near future they will be more or less universally adopted.

For the past three years opinion has been divided between the advocates of an active sulphur hypoid oil and those preferring a mild-type E.-P. oil. Active sulphur hypoid oils are those which quickly tarnish a bright copper plate, whereas the mild-type E.-P. oils are more stable and less corrosive.

The mild types include sulphur-saponifiable combinations, *i.e.*, mineral oils containing approximately 20 per cent. of a sulphurised or chlorinated fatty oil base. Included in this group are also certain phosphorus compounds.

There has been, and still is, considerable diversity of opinion as to the respective merits of each type, but there are now definite indications that the active sulphur hypoid oils will be eventually superseded by the mild-type E.-P. oils. These oils are proving perfectly satisfactory in service, and as they are more stable and less corrosive than the hypoid oils, they have the advantage of being used in transmissions as well as rear axles.

## Extreme-Pressure Greases

In the field of extreme-pressure grease lubrication successful results have been obtained with compounded lime and/or lead soaps plus mineral oil and sulphurised or chlorinated base products, used either singly or in combination, together with certain phosphorus compounds.

The checking of these greases offers little difficulty; sulphur, chlorine, and lead soaps are estimated in addition to the usual chemical and physical tests. Satisfactory estimations of sulphur and chlorine have been found possible by using the Parrs bomb if the usual precautions are taken.

Corrosion tests are more important than with ordinary greases, on account of the nature of the additives. A suitable test is to submerge the copper and steel test-plates in the grease and hold for 1,200 hours at atmospheric temperature, or for a much shorter time at an elevated temperature.

It is advisable to check the property of resistance to water very carefully, as some E.-P. greases take up large quantities of water—in fact, very few are truly water-repellant. It has been found that the characteristics of these greases in the presence of excess water vary considerably. Some thin down to such an extent that they would be quickly washed out of the bearings, while others absorb large quantities in forming emulsions of different degrees of stability. To test this property, a quantity of grease is churned up with water, added a little at a time, and stirred until it is absorbed or the grease thins down. If an emulsion is formed which does not thin down, the addition of water is continued until free globules exist. The percentage water content is then checked by the Dean and Stark distillation method.

## Corrosion, Load and Stability Tests

The usual 1,200-hours corrosion check is conducted on the emulsions, and those showing staining or corrosion are rejected. In addition to these tests, those described under lime-soap greases are also made. All E.-P. greases must carry a load of 43 lb. on the load-lever arm of the Timken machine in order to be approved. The ultimate breakdown load is also determined and recorded. If the grease successfully passes this test, an abrasion test at 33 lb. for 2 hours is run. The test components are weighed before and after, to determine the loss in weight.

Finally a stability test is made on the grease used during the abrasion test.

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The following are synopses of other papers on testing lubricants presented at the meeting:—

*A Tentative Laboratory Test for the Ring-Sticking Properties of Lubricants.* By J. C. McNicol, C. G. Williams, M.Sc., and P. V. Lamarque, B.Sc. (Research Department, Institution of Automobile Engineers).

A description is given of a simple laboratory test for assessing the oxidation and ring-gumming propensities of engine lubricants. The test, which consists principally in measuring the strength of a thin oxidised film of the lubricant, has been used for a preliminary study of the oxidation process over a range of temperatures and exposure times in the case of one lubricant, and at a fixed temperature in the case of a number of petrol- and diesel-engine lubricants of known service performance. Although the information obtained so far is not extensive, it is shown that, in lubricants which are prone to cause ring-sticking in diesel engines, the strength of the oxidised film is much higher than in the case of lubricants giving comparative freedom from ring-sticking. In addition, it is shown that high film strength is associated with high viscosity index of the lubricant. In the limited number of petrol-engine lubricants examined, volatility appeared to be a better criterion than the strength of the oxidised film.

*Extreme Pressure Lubricant Tests with Pretreated Test-Pieces.* By J. P. Baxter, Ph.D., C. I. Snow, B.A., B.Sc., and I. T. Pierce, M.Sc. (Imperial Chemical Industries, Ltd.).

Experiments with the Timken and Four Ball lubricant testing machines are described, in which considerable increases in the breakdown loads of doped and undoped oils were obtained by pretreatment of the test-pieces with chlorinated or sulphurised dope or with hydrochloric acid. Running-in tests showed that the layer so formed was not removed by running under loads below the breakdown load. The pretreatment of the Cornell (or Falex) test-pieces had no apparent effect, but when these were hardened to a value comparable with that of the other machines, the breakdown loads became too high for the machine to measure. The formation of the layers is discussed briefly.

## General Remarks on Testing

*Some remarks regarding the testing of engine lubricants.* By C. A. Bouman ("Delft" Laboratory, Royal Dutch Shell).

Only a few of the characteristics of motor oils can be determined by physico-chemical analysis. Oxidation tests do not represent the various processes of deterioration taking place in the engine; such great differences exist between processes taking place in various parts of the engine that oils are not rated in the same order of merit for them all. Also, deterioration of engine oil is often a matter of contamination with combustion products, particularly in I.C.-engines.

Carbon tests are only of some value with regard to carbon formation in the combustion space; not, however, with regard to carbon formation in piston-ring grooves or to the tendency to stick rings. Engine tests are necessary, but wearisome, as the degree of reproducibility required is often too small to allow of reaching a sound conclusion from only a few tests. In particular, the test conditions must also be chosen so as to give a good correlation with those conditions in practice for which an oil is intended.

*The Application of Graphical and Statistical Methods of Hydrocarbon Analysis to Diesel Fuels.* By J. C. Vlugter, H. I. Waterman and H. A. van Westen (Chemical Engineering Laboratory, Delft University).

It does not appear to be desirable at the present time to derive a new formula for the correlation between chemical composition and the ignition delay of diesel fuels, but this might be possible in the near future if more data on accurately analysed diesel fuels with known cetene values were available.

If the influences of various percentages of different dopes are not taken into consideration, and attention is restricted, therefore, to the examination of hydrocarbon mixtures, then the work started by Kreulen is promising. This is confirmed by the authors' own results.

A more thorough investigation of a large number of diesel fuels will be necessary in order to study the influence of chemical composition on the cetene or cetane value. In this respect it will be advisable to examine a large number of hydrogenated fuels, practically free from sulphur-, nitrogen-, or oxygen-containing bodies, together with extracts and raffinates derived from these fuels, and also oils obtained by polymerising olefines or olefine mixtures.

# Young Chemists as "Key" Men

## Dr. Herbert Levinstein on an Unfair Exception

**Dr. Herbert Levinstein.**

IN a letter published in *The Times* of Tuesday, DR. HERBERT LEVINSTEIN protested against the inclusion of chemists and "chemical engineers" of 21 years of age as "key" men in the revised schedule of reserved occupations issued by the Ministry of Labour. He said: "It is indeed a dreadful thing that we, in common with every European nation, should be making preparations to send any of these young men, the flower of our youth, into battle. But if any have to go, is it not better that all should take their chance? Personally I love chemistry, and am happy in the society of my colleagues. If any young men of 21 are to be exempted from the grim future which may lie before them, I would instinctively like them to be professional chemists. There is, however, in these exemptions a question of public policy of fundamental importance, namely, the creation, without adequate reason, of a privileged class of young man. To say that any ordinary young man who has just taken an honours degree in chemistry is a "key" man, or indispensable to a chemical works or to chemical industry, all practical industrialists know to be not merely untrue but absurd. Incidentally, many young men who have taken a first or second class honours degree in chemistry, which enables them to become an associate member of the Institute of Chemistry, are older than 21. In any event they are beginners. A couple of years later, when they have learned the technique of carrying out original work under the direction of an experienced chemist, they are ready to enter a chemical works. But they do not enter to teach. They enter to learn.

### Chemists of 21 not Indispensable

"It is incomprehensible to me, having lived through the last War and had the experience of building up great chemical factories during that period, that a young man of 21 who is rated as a chemist (not a pharmacist) should be considered indispensable to industry. If chemical industry has to be expanded the greatest shortage will again be found in the lack of charge hands and experienced foremen, not in that of young chemists of 21, in whatever school they have been trained.

"The Institution of Chemical Engineers, a specialised type of engineer, is the qualifying body for chemical engineers in this country. There is no class of trained men of whom during the last War there was a more acute shortage. For this reason the Institution of Chemical Engineers was after the War formed by men of great distinction in this profession.

"Owing to some curious arrangements made in the Ministry of Labour the classification for persons in the chemical engineering profession has been referred to the Industrial Chemistry Committee, no doubt a most admirable body of men. They have decided that a chemical engineer is not a specialised kind of engineer like a civil, mechanical, electrical, or gas engineer, but is an industrial chemist. This may or may not be a good debating point. The result is that a man calling himself a chemical engineer is now exempt at 21, just as if he was rated as a chemist. But no man, except for the purpose of securing exemption from the Army in war, can be a chemical engineer at 21. It is not quite so easy to be a chemical engineer as it is to secure exemption.

"The Institution of Chemical Engineers, whose job it is to know, does not admit, even as an associate member of the institution, any young man under the age of 25. The reason is perfectly clear. No young man can have had the minimum training and experience required to make him a chemical engineer before reaching that age. So the Ministry of Labour exempts a young man who calls himself a chemical engineer four years before he can be one. Surely, a breath of fresh air will blow away this nonsense. There is one good reason, and as far as I know only one, for which a boy, otherwise fit, who has studied chemistry or chemical engineering should be exempted from service in the field. If he is the sole or the main support of father, mother, or others dependent on him his duty lies at home, but not because he is indispensable for the manufacture of chemicals, or is made of different clay to other boys. During the last War the word "indispensable" became debased. Few men are indispensable at any age; very few at 21. To create such class distinction is dangerous. Our people will do anything for their country so long as there is fair play.

"The Germans in 1914 were the greatest military nation. They also led the world in chemistry and chemical industry. They did not exempt chemists aged 21, otherwise fit, from service in the field. Did they reserve any young men of 21? I loathe the idea of young men being sent into battle, but if any have to go, why make unfair exceptions? The Ministry of Labour is certainly doing this in the case of my own profession."

### OTHER OPINIONS

We have received the following two opinions on Dr. Levinstein's views.

PROFESSOR SIR ROBERT ROBINSON writes: Dr. Levinstein has put forward a general proposition, namely, that there should be no exemptions from compulsory military training and service, and illustrated it by a particular example, the proposed exemption of chemists and chemical engineers. Unfortunately he has allowed the considerations relevant to the one thesis to penetrate the field of the other and has not advanced two clear cut cases. Thus his penultimate paragraph cogently argues a question of interest to all sections of the public and he immediately proceeds to apply his views to the special case of chemists. If it is thought that as a matter of public policy there should be no exemptions of men up to the age of 21, then it certainly follows that chemists could not be exempted. But the discussion of the value of chemists to the nation in an emergency does not help us to make a decision on the wider issue which raises sociological and political rather than scientific or technological problems. Admittedly very few chemists of 21 can be regarded as indispensable and the situation would have to be considered afresh if the age limit were raised even by four years.

If, however, there are to be scheduled reserved occupations, if this is accepted as a general principle, then it must be because it is thought that certain classes of persons must, on the average, be more useful to the nation in the pursuit of their associations than as soldiers. The question of *indispensability* does not arise, it is rather a matter of assessing the probable usefulness of a section of the community in the prosecution of a war.

From this point of view I consider that the inclusion of trained chemists, even those aged 21 years, in the schedule

of reserved occupations is fully justified. Even in a war, I would say especially in a war, we shall need the hands as well as the leaders.

Moreover, nobody can safely prophecy that the next war will be a short one and it behoves us to provide a reserve of junior chemists from which the ranks of those who are called upon to shoulder heavy responsibilities can be recruited. We must anticipate an enormous extension of chemical services of all kinds, medical as well as manufacturing, and it is surely a wise policy to make plans at an early stage to cope with this probable development.

Returning to the starting point, all this goes by the board if the scheduling of reserved occupations is essentially wrong and in that case young chemists, who seek no special treatment for themselves, will be found as ready as any others to perform their duties.

A statement by DR. J. VARGES EYRE entirely endorses the views expressed by Dr. Herbert Levinstein. He writes: The people of greatest service in chemical industry in time of emergency are those with chemical knowledge who have already had experience of operating chemical plant. In my experience such people do not exist at the age of 21. Young men coming fresh from a university or technical college have spent most of their time rightly in understanding the fundamental principles of chemistry and cannot be expected to be useful on the industrial side until they have learned how to apply their knowledge to particular problems of industry. This requires several years of experience.

It is, therefore, ridiculous to claim that before they have had an opportunity of applying their knowledge to chemical industrial works, which become so important in times of emergency, they should already be classed as "key" men and indispensable. Dr. Herbert Levinstein has done a good service in throwing light on the possibility of this situation arising both as regards the chemist and the chemical engineer. It is doing a disservice to the profession of chemistry and to chemical industry in this country to attempt to label anyone as a "key" man or indispensable in case of emergency merely because he has made a study of that particular science. The effectiveness of a man's chemical service to his country in such eventuality turns more upon practical experience through service in the works than upon book learning and examination results. When, however, it comes to an absolute dearth of people with chemical knowledge there is no doubt that a young man fresh from the university may be easier to train to any particular job than an inexperienced senior without any such training.

Although these views relate to chemical industrial operations, in all probability the same applies to the inexperienced chemist as a laboratory research worker. At that early age they are of no greater value than as units in a team.

## BRITISH STANDARD FOR VETERINARY COD LIVER OIL

The third British Standard has just been issued by the British Standards Institution in the series of specifications which are being prepared for marine animal and fish oils. This specification has been prepared by a committee representative amongst others of the Royal College of Veterinary Surgeons, the National Farmers' Union and the Cod Liver Oil Producers. The specification besides giving the properties required for a good cod liver oil, includes methods for the assay of vitamins A and D which have been used by permission of the General Medical Council of the British Medical Association, together with extracts from the report of the Second Conference on Vitamin Standardisation held under the auspices of the League of Nations Health Organisation which has been incorporated by permission of the League of Nations.

Copies of this new British Standard (No. 839-1939) may be obtained from the British Standards Institution, 28 Victoria Street, London, S.W.1. (2s. 2d., post free).

# New South African Cellulose Plant

### First Plant in the Empire to Operate Chlorine Pulp Process

AT the end of 1938 the South African Pulp and Paper Industries, Ltd., started their new plant for pulp and paper at Geduld, near Springs, Transvaal, South Africa, it is reported by Pomilio (*Ind. Eng. Chem.*, News Ed., 1939, *17*, 328-9). Apart from being the first chlorine gas pulp plant in the British Empire, the Geduld factory is the first in the entire African continent for the manufacture of pulp and paper on a large scale.

This plant shows a step forward in the technique of chlorine cellulose. It is 100 per cent. continuous in all its chemical and mechanical stages. The Geduld plant consists of two sections: one for the treatment of straw, grasses, reeds, and annual plants in general, and the other for resinous or other woods. The second section is novel, inasmuch as resinous woods had never before been treated on a commercial scale by the chlorine gas process. Geduld has, however, shown that the chlorine process is not only applicable to resinous and even more to nonresinous woods but offers advantages over other processes, especially when high-quality bleached pulp is desired.

Besides the plant for fine, medium, and ordinary paper, the Geduld factory includes a plant for making cardboard from shives and tailings from the refiners and purifiers. While such materials give good cardboard, after suitable grinding and refining, their elimination from the mechanical cellulose cycles ensures the production of a finer pulp, absolutely free from shives. In previous plants the residues from the mechanical section were returned to the chemical cycle and eventually converted into cellulose.

In addition to pulp and paper the factory can produce hydrochloric acid. One of the characteristics of the Pomilio process is that by it there can be produced chemical by-products, such as caustic soda, liquefied chlorine, hypochlorite, and chlorine derivatives in general.

Geduld uses principally wheat straw from the farming district of Brits, about 70 miles from the factory, and *Pinus patula* wood from the forest district of the Northern Transvaal. Salt is obtained principally from a volcanic stratum of salt and carbonate of soda at Hammanskraal, north of Pretoria. The quality is of the best, containing only the slightest trace of alkali (no sulphates, lime, or magnesium) and it is therefore well adapted for electrolytic use. South African Pulp and Paper Industries, Ltd., are using 96 Giordani-Pomilio cells for soda and chlorine, each of 3,000 ampere capacity. Lime for bleaching solutions and talc for the paper section are also obtained locally, so that the Geduld plant may be considered 100 per cent self-sufficient.

The Geduld plant, which has cost over £500,000, can produce 24 tons of straw or grass pulp, 12 tons of wood pulp, 40 to 50 tons of various types of paper, and 4 to 5 tons of cardboard per day of 24 hours.

## NEW METHOD OF PREPARING ALIPHATIC DIAMINES

A new method for the preparation of aliphatic diamines is described by Darzens (*Comptes Rendus*, 1939, *208*, 1,503-1,504). The corresponding aliphatic dichloride to the diamine required is treated over an extended period with strong aqueous ammonia, which converts it to the hydrochloride of the diamine. This salt can then be converted to the diamine in the usual way by distillation with an alkali. The method is only applicable to alkylene dichlorides. Primary chlorides do not react at all, and tertiary ones only yield alkylenes in almost theoretical yield. The reaction with ethylene dichloride is completed in about 50 hours at 68°-70° C. At 75°-80° C., a quantitative conversion of propylene dichloride is attained in 8-10 days. No complex bases or other side-products are formed in either case.

# Pitch as Fuel

## Use in Liquid State or as Pulverised Solid gives Good Thermal Efficiency

PRESENT practice in the use of pitch as a fuel is described by Davies (*Jour. Inst. Fuel,* 1939, *12,* 65, 243-250). Two types of pitch are normally obtainable, one a "soft" variety with a softening point of about 70° C., the other "hard," with a softening point of 125-130° C. The calorific value of the latter is about 16,000 B.Th.U.'s per lb., while that of the former may be 16,500 or even higher.

The material may be burned either in the liquid state, or as a pulverised solid. Liquid burning has been applied for the firing of Lancashire boilers, and for this purpose it has been found best to maintain the pitch supply at about 250° C., feeding it to the burners through lagged pipes—these do not need to be steam jacketed unless they cross extensive open spaces. Steam atomisation yields much too long a flame, and a considerable amount of air is now used in addition, the remainder being injected into the flame tangentially at the point where the pitch stream enters the furnace. 1 lb. of the fuel requires 200 cubic feet of air for complete combustion, of which 60 may be used for atomisation. The flame length should be kept down to 6 feet.

The majority of pitch fired installations employ the pulverised fuel, which is easier to handle than in the liquid state. For grinding, the harder variety is desirable, and a high velocity air swept mill should be used, in which the operating temperature is low, so that flowing of the pitch does not occur. The burners used are of simple design, and the pulverised fuel is drawn into the injector by means of the primary compressed air supply. The rate of flame propagation in the burning power is 80 ft. per second, so that the nozzle velocity of the mixture leaving the burner must be higher than this, to avoid combustion of the pitch inside the burner.

A 10 per cent. better thermal efficiency is obtained with pitch in comparison with oil, which the former is often used to replace. Pitch is also easier to grind than coal, requiring only 75 per cent. of the horse power necessary for coal pulverisation.

# Silicosis Prevention

## Inhalation of Aluminium Powder

WORK undertaken by Mr. J. J. Denny, metallurgical engineer, McIntyre-Porcupine Mines, Ltd., and his associates Messrs. W. D. Robson, chief surgeon to the company, and D. A. Irwin, Department of Medical Research, University of Toronto, for the prevention of silicosis by metallic aluminium, is making satisfactory progress, according to a paper in the April issue of the "Bulletin of the Canadian Institute of Mining and Metallurgy." Experimental work with this object in view has been in progress at the McIntyre mine for some time past, and certain methods have been devised whereby an excellent dispersion of the powder can be obtained in the underground atmosphere. By using small quantities of aluminium powder dispersed in a dust cloud, reduction of 90 per cent. or better in the solubility of the siliceous material, from which silicosis is developed, were obtained from dust samples taken 150 to 300 feet from the face following a drift-round blast having a volume of 8,000 cubic feet.

The investigations are still in progress, but among the conclusions reached from the work so far undertaken are that to prevent silicosis aluminium dust may be inhaled daily independently of the siliceous dust; that the aluminium dust must be sufficiently concentrated in the inhaled dust to provide minimum concentration in the lung of 1 per cent. at all times; and that aluminium dust in any concentration necessary to prevent silicosis is hundreds of times below the explosive concentration of aluminium powder.

# Chemical Manufacturers in Voluntary Liquidation

## Ranking Liabilities of £17,215

THE statutory meeting of creditors of Petri Bros., Ltd., Lloyd's Avenue, London, E.C.3, chemical manufacturers, etc., was held recently when Collet, Thomas and Co., C.A., 61 Chancery Lane, London, W.C., submitted a statement of affairs which showed ranking liabilities of £17,215 10s. 3d. Of that amount £10,977 6s. 2d. was due to unsecured trade creditors, and there were cash creditors for £3,300. In addition there were various partly secured creditors. The assets made a total of £3,952 1s. 7d., or a deficiency, as regarded the creditors, of £13,263 8s. 8d. The issued capital was £4,500, and so far as the shareholders were concerned there was a deficiency of £17,763 8s. 8d.

### Trading Figures

The trading figures showed that during the year to December 31, 1934, the turnover was £128,473, with a gross profit of £9,472, and a net profit of £1,468. In the following year the sales went down to £77,203, with a gross profit of £4,876, and a net profit of £140. During the 12 months to December 31, 1936, the turnover still further declined to £58,276, the gross profit went down to £4,123, and the net profit was reduced to £37. In the succeeding accounting period the turnover went up to £138,821, but the gross profit was only £6,787, with a net profit of £76.

After discussing the position it was decided that the voluntary liquidation of the company should be continued with Mr. Collet, of Collet, Thomas and Co., and Mr. W. H. Cork, of W. H. Cork and Co., accountants and auditors, 19 Eastcheap, London, E.C., as joint liquidators. The following are creditors, but the amounts given are gross and some creditors are partly secured:

Boots Pure Drug Co., £194; Barter Trading Corpn., £176; Brookes & Green, £638; Consortium für Elektrochemische Industrie, £125; Dessauer Werke, £255; Dalton & Young, £2,480; English Fat Refining Co., £314; Geigy Colour Co., £189; Greenshields, £148; Guttler & Co., £1,090; I.G. Farbenindustrie, £985; Ide & Christie, £1,336; Kiver, Henry, & Partners, £2,202; Kalk, Chemische Fab., £1,390; Pasquale & Co., £390; Price, Stutfield, £216; Sale, Tilney & Co., £6,235; Steel, J. M., £388; Standard Synthetics, £163; Sthamer, Dr. R., £174; Slann & Davies, £148; Warrington Chemical Co., £538; Welby Francis, £688; Wacker, Dr. A., £1,973; Creditors under £100 each, £1,191.

# Physics in Industry

## Growth of Profession—A National Register of Physicists

THE growing importance of physical science in almost every branch of modern industry is reflected in a 15 per cent. increase in the membership of the Institute of Physics, the annual report of which was issued recently. At the end of 1938 the membership stood at 1,169 as compared with 753 as recently as 1934.

The report states that in September of last year the Institute undertook to compile an emergency register of its members and there was an immediate response from those not already engaged in work of national importance. The National Service Department of the Ministry of Labour was in constant touch with the Institute. A particularly successful undertaking had been the holding of "summer schools" at university centres to assist members in keeping up to date with recent discoveries in pure and applied physics. Last year's summer school was held at Reading. Discussions were held during the year by the Institute's branches on such varied subjects as cosmic rays, the strength of materials, the science of illumination, and the development of sound-locaters for anti-aircraft defence. The President of the Institute is Dr. C. C. Paterson, and the hon. secretary is Professor J. A. Crowther of the University of Reading.

# Factory Lighting

## The Types of Problem Encountered

THE recent Factory Act lays it down that "suitable and sufficient lighting" should be provided for every factory, but this is more for the safety and welfare of the operatives than as an aid to factory production. It is advocated that artificial lighting should always be employed in greater or lesser degree even during actual daylight, but this in itself is no cure for all the lighting ills that beset factory executives.

The majority of lighting problems incidental to specialised processes are generally easy of solution by the competent lighting engineer. These factory lighting problems can generally be classified under three main headings, such as :—

(a) Where the nature of the work calls for light of a special quality, or is desired from a special direction—such as is often required for inspection processes, and for positional manufacturing operations.

(b) Where the atmosphere is laden with moisture, fumes, or inflammable vapours, which calls for special protective types of fittings.

(c) Where a special quality or colour composition of light is necessary.

Careful examination of these categories prompts the question as to what is meant by "special quality" light, as in (a). This may be one of several kinds, such as that diffused from a wide angle source provided by indirect lighting, or from a relatively small source such as a glass steel diffuser. Again it may be concentrated from a wide angle such as is provided by certain types of lighting units used in hospital operating theatres, or from a narrow angle, as with a narrow beam floodlight reflector. Further, these forms of light may be mixed together in greater or lesser proportion and arranged to illuminate the working plane from different directions and angles of elevation.

Another point is that the light may vary in spectral composition and it is necessary to consider this where category (c) is concerned. Other functions of spectral composition are, however, pertinent to the problems associated with "special qualities" of light referred to in category (a). For example, under electric discharge lighting of the high pressure mercury vapour kind, visual acuity is increased, and sharper definition of objects of certain kinds is obtained. This is a phenomenon that has not yet been fully explained, although it has proved of very practical importance in a number of inspection processes associated with certain industries, particularly in regard to the detection of flaws, blemishes, and other imperfections.

Special fittings are required for use in moisture or fume laden atmospheres, for the dangers of corrosion and other deleterious effects have to be carefully guarded against. Lighting fittings for use in surroundings where inflammable or explosive vapours are present are subject to Home Office regulations, but very often suitable lighting can be provided by installing it outside the danger area, and so arranging it that more efficient illumination is obtained than by using specially prescribed fittings in the actual danger area.

Much ingenuity has been expended on the provision of special colour qualities in lighting for industries such as that of paper-making. When compared with actual daylight the apparent colour of many articles appears distorted when tungsten lamps are employed without the use of filters, or arrangements for eliminating or correcting certain colour contents of the light.

The carbon dioxide discharge method of lighting, however, has a greater constancy than actual daylight and it allows the establishment of an absolute standard of colour values under all conditions. Many industrialists now carry out their matching processes under this method of artificial lighting, and actually exclude daylight. Such a form of lighting is of particular value to the paper making industry, printing ink manufacturers, and the printing trades.

# Cadmium and Zinc Silicate Phosphors

## Preparation and Characteristics

THE characteristics of cadmium and zinc silicate phosphors have been studied by Fonda (*Jour. Phys. Chem.*, 1939, *43*, 561-577). The phosphors were prepared by heating silica and zinc or cadmium oxide together with a small quantity of a manganese salt, at temperatures of 850°-1,250° C. The mixture of silica and zinc oxide was in some cases obtained by adding zinc (and manganese) nitrates to ethyl silicate, converting the latter to a gel, and then denitrating.

The progress of the interaction of the oxide with the silica was followed by determining the fluorescence intensity of the mixture. It was established that the controlling process was a diffusion one, the heat of diffusion being 20-24 calories. The formation of a shell of silicate on the outside of the oxide grains reduces the rate of diffusion of the silica (or *vice versa*), and the addition of fluxes increases the rate very considerably, but reduces the maximum fluorescent power attained. Addition of volatile chlorides, particularly of cadmium chloride, has a very marked accelerating effect also, but here again the maximum fluorescence is reduced, although not so much.

It appears to be fairly certain that manganese is the activating agent: no fluorescence is obtainable in its absence, the optimum addition is 0.4 per cent., and the fluorescence intensity thus obtained is independent of the temperature from 77° to 373° absolute. Further additions of manganese reduce the fluorescence at room temperature, but the intensity approaches the maximum as the temperature is reduced to 77° K.

The fluorescence intensity is also dependent on the silica-oxide ratio in the case of the zinc phosphor, and is at a maximum when the composition corresponds to that of the orthosilicate $Zn_2SiO_4$, but excess silica does not affect the intensity much until the product has been ground, the silica apparently being dispersed as very fine colloidal particles on the surface of the silicate grains.

There appears also to be an optimum grain size distribution (4-5$\mu$), and reduction in the average particle size leads to a reduction of the fluorescence. The activating effect of manganese atoms is thought to be due to a distortion of the silicate lattice by the substitution of manganese atoms for some of the zinc or cadmium atoms; it is essentially an internal effect, and surface atoms do not contribute much to the development of fluorescence. The exciting wavelengths are all included between 2,225 and 3,000 Å. Very high quantum yields were found with some lines.

# Institute of Chemistry

## Fellowship Examination Pass List

THE results of the April examinations for the Fellowship of the Institute of Chemistry of Great Britain and Ireland are as follows :—

*In Branch A : Inorganic Chemistry :* Thomas Linley Bowyer, M.P.S. ; *with special reference to the metallurgy of iron and steel :* Norman Reginald Hall.

*In Branch C : Organic Chemistry, with special reference to oils, fats, etc. :* Basil Houghton Chorley, Herbert Kent Hartley, B.Sc. (Manc.), Richard Arthur Jones, A.C.G.I.C., Charles Fletcher Roberts, A.M.C.T.

*In Branch D : Biochemistry, with special reference to vitamins :* Ronald Leslie Edwards, Ph.D.(Lond.).

*In Branch E : The Chemistry, including microscopy, of food and drugs, and of water :* Percy Roy Clemow, B.Sc.(Lond.), Oswald Hitchen, B.Sc.Tech.(Manc.), Robert Leopold Kenny, B.Sc.(Lond.), Walter Frederick Waters, B.Sc.(Wales).

*In Branch G : Industrial Chemistry : with special reference to oils, fats, etc. :* Norman Charles Jabez Jeffery, B.Sc.(London ; *with special reference to the manufacture of rayon :* Stanley Kenneth Covington, B.Sc.(Lond.).

*In General Analytical Chemistry :* Frederick George Angell, Ph.D.(Birm.), Leonard Arthur Haddock, M.Sc.(Lond.).

# Personal Notes

PROFESSOR W. L. BRAGG is to receive the honorary degree of D.Sc. of Leeds University at a congregation to be held on July 3.

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MR. A. J. GIBSON, president of the Oil and Colour Chemists' Association, has postponed for a few months his tour to the U.S.A. owing to pressure of work.

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MR. HARRY BREARLEY, a director of Brown Bayley's Steel Works, Ltd., and a pioneer in the development of stainless steel, will receive the honorary freedom of Sheffield on June 6.

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MR. N. G. BLENKINSOP has resigned his position as managing director of May and Baker, Ltd., and director of Pharmaceutical Specialities (May and Baker), Ltd.

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MR. PETER CLARK and MR. GEORGE W. STEWART have been appointed to act as deputy gas examiners in the testing of calorific value, pressure and purity of gas at Stirling.

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MR. ROBERT T. POTTER, assistant chemist with Robert Hutchison and Co., Ltd., flour millers and maltsters, Kirkcaldy, who is a student at the evening classes of Heriot-Watt College, Edinburgh, has been awarded the College medal and certificates in the fourth year of the national certificate course in chemistry.

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DR. E. W. R. STEACIE, Associate Professor of Chemistry at McGill University, has been appointed director of the Division of Chemistry, National Research Council of Canada, in succession to Dr. G. S. Whitby, who recently resigned to accept the post of director of the Chemical Research Laboratory, Teddington.

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MR. L. F. BRAGA (Plant Protection, Ltd.) was elected chairman of the Association of British Insecticide Manufacturers at the annual meeting of the Association recently. MR. H. J. JONES (Hemingway and Co., Ltd.) was appointed hon. treasurer, MR. R. A. BLAIR (Burt, Boulton and Haywood, Ltd.) hon. auditor, and the following were elected to the executive committee: MESSRS. R. A. BLAIR (Burt, Boulton and Haywood, Ltd.), W. V. BLEWETT (Imperial Chemical Industries, Ltd.), E. Z. BOLT (G. H. Richards, Ltd.), R. V. CRAVEN (W. J. Craven and Co., Ltd.), J. S. MITCHELL (The Murphy Chemical Co., Ltd.), and DR. J. H. REID (The British Nicotine Co., Ltd.). MR. J. DAVIDSON PRATT was appointed secretary.

## OBITUARY

MR. HERBERT ROBERTS, governing director of Herbert Roberts, Ltd., dyers and finishers, Royal Works, Keighley, died recently at the age of 65.

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MR. WYBERT FIRTH, works manager for the Consett Iron Co., died last week at the age of 58. Mr. Firth joined the Consett Iron Co. in 1917 as chief engineer and three years later was made works manager.

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MR. ERIC HANNAFORD RICHARDS, managing director of Adco, Ltd., of Harpenden, died recently at the age of 60. Mr. Richards went to Rothamsted Experimental Station in October, 1913, as the Earl Iveagh Research Chemist and head of the Fermentation Department. While working at Rothamsted he discovered, in collaboration with Dr. H. B. Hutchinson, a process of accelerating the decomposition of waste vegetation. As a result the Adco company was formed by Earl Iveagh with the object of developing the process on its commercial side, and Mr. Richards became managing director.

MR. JOHN ALEXANDER COCKBURN, M.B.E., F.I.C., who retired from the services of Imperiod Chemical Industries, Ltd. in 1928, died at the age of 68 on May 20. Mr. Cockburn studied analytical chemistry under Stevenson Macadam at the Surgeon's Hall, Edinburgh, and later he went to the Anderson College, Glasgow, where he studied under Professor Dittmar. After some time at Nobel's works, Ardeer, Mr. Cockburn was sent by the company, over 30 years ago, to open a factory in Japan, where he remained for several years. During the war he was works manager at Nobel's and for his services in explosive work was awarded the M.B.E. He retired in 1928.

**The late Mr. John Alexander Cockburn.**

SIR WILLIAM W. BUTLER, chairman and managing director of Mitchells and Butlers, Ltd., brewers, who died on April 5, has left estate valued at £552,615 (net personalty £534,472). Legacies include £1,000 to Birmingham University, for research work in the British School of Malting and Brewing and Department of Bio-Chemistry of Fermentation; £500 to Birmingham Corporation for prizes or scholarships in chemistry, engineering, or metallurgy; £500 to Birmingham Corporation, for purchasing a collection of scientific works of reference for the Birmingham Municipal Technical School Library; £500 to the Institute of Brewing, desiring that once in every three years the income should be used to provide a medal in recognition of the services of any person or firm who has aided the advancement of the science of brewing or malting.

## PREPARATION OF HIGH PURITY OLEIC ACID

A combination of existing purification methods has been worked out to give an oleic acid of very high purity by Hartsuch (*Jour. Amer. Chem. Soc.*, 1939, 61, 1,142-1,144). The first rough separation of the fatty acids from olive or teaseed oils is accomplished by crystallisation from a 10 per cent. solution in acetone at − 20° C., the solution being kept cool for 4-5 hours and then the saturated acids which crystallise under these conditions filtered off at − 14° C. The filtrate is next cooled to − 60° C., and the oleic acid which crystallises out at this temperature is recrystallised a further three times at − 40° C. This procedure removes nearly all of the linoleic acid and gives a product which is 94 per cent. pure. A further quantity of fatty acid is next removed as the lead salt by treatment with lead acetate in alcohol, and finally the acid thus obtained is fractionally distilled at a pressure of 1 mm. In this way a product is obtained which is 97.8 per cent. pure, the impurities being all of an unsaturated nature. It is considered that this represents the purest sample obtained so far.

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Magnetism and chemistry. Klemm, *Chem. Ztg., 63,* 333-335.

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# General News——————From Week to Week

THE OLD LEAD MINES at Rookhope, Co. Durham, which were recently closed down, are to be re-opened by the owners, the Weardale Lead Co.

BEUGGER CHEMICALS, LTD., manufacturing chemists, Elstree Way, Boreham Wood, Herts, recently changed their name to Evans Chemicals, Ltd.

FIRE BADLY DAMAGED a wooden jetty under construction at the new wharf of Burt, Boulton and Haywood, Ltd., timber merchants and tar distillers, Belvedere, S.E., on Tuesday.

THE ROCKEFELLER FOUNDATION has made a gift of £23,000 to Oxford University to provide and equip a research laboratory for organic chemistry. The gift was recently acknowledged in congregation.

GOVERNMENT CONTRACTS.—Spencer, Chapman and Messel, Ltd., have received a contract for sulphuric acid from the Post Office. R. Sumner and Co., Ltd., have received a contract for drugs from the Prison Commissioners.

AT A MEETING of Morecambe and Heysham Town Council last week objection was expressed to an Air Ministry proposal to build a chemical factory at Middleton, on the outskirts of the resort, at a reputed cost of £6,000,000. The Council passed a resolution that, while appreciating national necessity, they considered such a factory would be a serious menace to the town's amenities and development. A deputation was appointed to interview the Air Minister and state objections.

AN INFORMAL CONFERENCE on internal strains in solids will be held at Bristol University under the joint auspices of the Physical Society and Bristol University from July 11 to July 13. Subjects for discussion which have been provisionally arranged include "Slip in Metal Crystals," "Diffusion in Solids," "Precipitation Hardening," "Recrystallisation and Effect of Grain Size on Mechanical Properties of Solids," "Internal Friction in Solids," "The Magnetisation Curve of Ferromagnetic Materials."

A BRITISH STANDARD CODE (No. 845) has just been issued by the British Standards Institution for commercial acceptance tests for steam boilers. The object of this code is to indicate the methods which should be adopted and the data which it is desirable to obtain when carrying out a simple efficiency test at minimum cost, on steam-raising plants using solid fuel, to obtain a satisfactory measure of performance under reasonably steady load conditions. The code is not intended for use in the very comprehensive tests carried out on large power station boilers, for which the code included in the report of the Heat Engine Trials Committee of the Institution of Civil Engineers should be used. It is recommended that if in addition to the efficiency test an overload test is required, it is sufficient to collect data to establish the capacity of the boiler only, as the overload period is in most cases too short to allow of accurate results being obtained. Copies of the code can be obtained from the British Standards Institution, 28 Victoria Street, London, S.W.1, price 2s. (2s. 2d. post free).

THE COMMISSIONER FOR THE SPECIAL AREAS in England and Wales reports that during the two months ended April 30 seven tenants took possession of factories. At the end of April, the total number of completed factories was 105, of which 97 were occupied and 95 in production, employing 2,603 people. Six further factories were under construction. On the South Wales Trading Estate at Treforest, nine tenants took possession of factories during the two months and construction of five further factories was begun. At the end of April the total number of completed factories on the estate was 54, of which 43 were occupied, giving employment to 1,518 people. During the months of March and April offers of contributions towards rent, rates and income tax were made to eight industrial undertakings to induce them to set up factories in the Special Areas, bringing the total number of offers of this nature to 91. The Commissioner's total commitments at the end of April, 1939, in respect of all the Special Areas in England and Wales were approximately £18,612,000. The total expenditure involved, excluding the capital brought into the areas by new firms being established on the Trading Estates and elsewhere, was more than £25,000,000.

BRITISH ANODISING, LTD., Merton, Surrey, are to carry out extensions to their works. De Pass Fertilisers, Ltd., Creekmouth, Barking, are also extending their works.

FIRE BROKE OUT on Sunday afternoon at St. Leonard's paper mill owned by J. Tod and Son, Ltd., Lasswade, Midlothian, and completely destroyed 60 to 70 tons of wood pulp in bales stored in a single-story brick building.

A CONTRACT for the supply of 30 coke ovens has been placed with Simon-Carves, Ltd., Stockport, by William Baird, Ltd., Coatbridge, for erection at Kilsyth to replace an old battery. The contract includes plant for compressing, stamping, screening, foundations, and electrical gear.

IN REVIEWING "Casein and Its Industrial Application" in THE CHEMICAL AGE of May 20 (p. 378) we erroneously stated that the book was published by the McGraw-Hill Publishing Co., Ltd. The publishers are Chapman and Hall, Ltd. (New York: Reinhold Publishing Corporation).

IT WAS ANNOUNCED on Wednesday that negotiations are almost completed for the acquirement of a site at Port Talbot Docks by Metallurgical Industries, Ltd., London. It is proposed to erect an aluminium melting furnace to be operated in conjunction with a de-tinning factory being erected.

THE CHANCELLOR OF THE EXCHEQUER on Monday received a deputation from supporters of the Government with reference to Section 7 of the Finance Bill which provides for the repeal of the medicine duties. After leaving the Chancellor it was decided to put down an amendment to omit Section 7 when the Finance Bill reaches Committee.

KEY INDUSTRY DUTY.—A representation has been made to the Board of Trade under Section 10 (5) of the Finance Act, 1926, regarding methylamine. Any communication should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1, before June 5, 1939.

FOUR MILLS at the Morfa Tinplate Works, Llanelly, will restart work next week, and a fifth will be re-opened later. The employment of over 200 men is involved. The works have been idle for more than a year and are now being taken over by Richard Thomas and Co., Ltd. The Cardonnel Tinplate Works, Skewen, Swansea, which have been closed for 15 months, are also being prepared for work.

AS FROM YESTERDAY (FRIDAY) the imported duty on unwrought zinc is raised from 12s. 6d. to 30s. a ton. This decision was announced by the Treasury on the recommendation of the Import Duties Advisory Committee. The increased duty is one of a number of proposals made by the committee for amending the arrangements introduced in 1935 following an earlier inquiry into the working of the lead and zinc agreements concluded at the Ottawa Conference in 1932.

THE JOINT COMMITTEE ON MATERIALS AND THEIR TESTING have published reprints of the second general discussion on non-destructive testing held under their auspices in London on November 25, 1938. All the papers then presented, with th report of the discussion and communications, are now available as reprints from the "Journal of the Institution of Electrical Engineers." The volume constitutes a valuable collection of international views on current practice and opinion in this important branch of testing. Copies (about 81 pp.) are available in paper covers at the price of 3s. 6d. post free from the secretary, the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2.

MR. JUSTICE BRANSON dismissed with costs a claim in the King's Bench Division last week by Mr. Maria Peter Josef Siegfried Graaf, a German research chemist and inventor, against British Belting and Asbestos, Ltd., Southwark Street, London, S.E. Mr. Graaf sought reasonable remuneration for experimental work in connection with the production of coloured asbestos-cloth with a shiny surface. Alternately, he claimed damages for alleged breach of contract. The defence was a denial that Mr. Graaf was engaged by the asbestos company to do the work for which he now claimed remuneration. Giving judgment, his lordship said that Mr. Graaf had failed to establish that he was appointed to do experiments for the company.

# Foreign News

NEW FACTORIES OF THE RHEINISCHE KUNSTSEIDE A.G. at Krefeld have commenced production of rayon and staple fibre.

THE UNITED STATES is to permit foreign Governments to purchase 500,000 cubic feet of helium for medical, scientific and commercial purposes, the new rule being made chiefly to enable Poland to buy helium for a stratosphere observation dirigible.

AS A POTENTIAL SUBSTITUTE FOR BAUXITE in the aluminium industry, a new variety of corundum discovered in the Boliden ores and containing 35 to 40 per cent. of aluminium is now being investigated by the Svenska Aluminiumkompaniet A.B. of Mansbo.

METALLIC BISMUTH is now being produced in an experimental plant of the Novossibirsk branch of the Russian Institute for Rare Metals from residues of the tungsten ore-dressing plant at Sabaikalje and from copper-bismuth concentrates worked up from deposits at Adrassman.

AN EXCELLENT ACTIVATED CARBON FOR GASMASKS can be produced from de-oiled chestnut skins according to Gandini and Brambilla (*La Chimica e l'Industria*, April 1939). Grape seed and tobacco seed are also promising raw materials for the same purpose after compression of the carbonised products.

GREAT PROGRESS HAS BEEN MADE IN GERMANY with the conversion of omnibuses to liquefied gas propulsion, the number of converted vehicles having risen from 4,300 at the end of 1936 to over 19,000 at the end of 1938. The gaseous fuel, which is a by-product of the coal-hydrogenation industry, is marketed in steel cylinders of which some 120,000 are now in circulation.

THE IMPORTS OF CHEMICALS and allied products into the Philippines advanced 22 per cent. in value to $9,143,000 in 1938 from $7,527,000 in 1937, according to the American Trade Commissioner in Manila. With the exception of fertilisers, all the leading classes shared in the increase. Imports from the United States totalled $6,812,000 in 1938, compared with $4,897,000 in 1937. Imports from Germany declined 32 per cent. and those from Japan 7 per cent. The largest increases from the United States were among the medicinal classes, and Germany's largest losses were in fertilisers. Japan previously a leader—particularly in the lower grades of chemicals—showed losses. Her only gain of importance being in sulphuric acid.

THE PRODUCTION OF ESSENTIAL AND MEDICINAL OILS and certain by-products is receiving considerable attention in Australia where it is reported that a firm in Western Australia is now producing menthol and thymol from locally-produced eucalyptus oils. Ti-tree oil is also attracting interest and it is estimated that its production as a medicinal in the preparation of skin ointments totals approximately 2,000 gallons per annum. In Tasmania an important essential oil is being produced from the Huon pine. This oil, the principal constituent of which is methyleugenol, is an excellent antiseptic and exports now amount to 10,000 lb. per annum. Action is being taken by the Government authorities and distillers of eucalyptus oil to conserve eucalyptus yielding commercial oils by reafforestation of selected areas with these species. Sandalwood, orange, lemon, lavender and rosemary oils are also being produced in the Commonwealth, while imported products are being treated for their essential essences and oils.

CONFIRMING THE RECENT TREND to use smaller quantities, but better qualities of bleaching clays, figures issued by the U.S.A. Bureau of Mines for fuller's earth consumption in the United States show a 24 per cent. drop in 1938. Domestic production of fuller's earth or natural bleaching clays declined to 170,852 short tons compared with 226,165 tons in 1937 and 230,814 tons in 1936. Imports, which during the last decade have averaged less than 1½ per cent. of annual consumption, also decreased further in 1938, while exports increased, though not appreciably. The predominant use of fuller's earth is in oil refining. Following a temporary setback in the early years of the general business depression, petroleum refining resumed its strong upward trend, whereas the use of fuller's earth failed to increase after in 1936. Imports, which during the last decare have averaged with the greater activity in petroleum refining is due in part, states the Bureau, to a relative reduction in the output of lubricants which is the branch of the refining industry that uses the largest proportion of bleaching clay. But new methods of processing that require much smaller additions of fuller's earth, and the substitution of other bleaching materials—first, activated earths and in 1938, bauxite—are even more depressing factors.

THE PRESENT OUTPUT of refined glycerine in Germany is reported to be 4,000 kilogs per day.

A PROCESS FOR THE MANUFACTURE OF ADHESIVES FROM SEAWEED (presumably on an alginate basis) has been developed at the Tomomasu Chemical Research Laboratory at Kawabegun (Hyogo Prefecture), Japan.

EXPERIMENTS conducted in the Belgian Congo with the cultivation of *Cinchona Ledgeriana* have been pronounced as successful by officials at Government experimental stations who are reported to be co-operating with a Belgian chemical firm in establishing plantations.

THE SOUTHERN RHODESIAN GOVERNMENT recently made an order which provides for a rebate of customs duties on the first importation of various articles, including dressings, cements, putties, acetone and cellulose lacquers with their ingredients, cleaners and waxes, polishes, blacking, marking and embossing inks and solvents.

THE FIRST IRON AND STEEL FACTORY in the United Provinces, India, will start work at Cawnpore some time next month. The factory, the erection of which is nearing completion, has an electric steel furnace for melting scrap iron from which it will manufacture iron bars, flats, angles, hoops, etc. The furnace will produce six tons of molten steel in 24 hours.

THE DECHEMA, German Chemical Engineering Society, has removed its offices (Dechema-, Achema- and Standard-office) from Berlin to Frankfurt a.M., Dechema-Haus, Bismarckallee 25. A branch office will remain in Berlin, Haus des Vereins Deutscher Chemiker, Potsdamer Str. 111, Berlin W.35. The Dechema has recently published its 1938 progress report.

IT IS REPORTED that during 1938 Germany, the world's leading producer of barytes ore, suffered a decline in the exports of crude and refined barytes as compared with 1937. Exports of crude barytes during 1938 totalled 94,149 metric tons compared with 119,705 metric tons in 1937 and of ground barytes (blanc fixe) 70,173 metric tons compared with 81,970.

A SERIES OF EXPERIMENTS has been carried out under Professor H. N. Bose of the Benares Hindu University to determine the compositions of suitable spinels to replace tin oxide as opacifiers in enamels and glazes. Encouraging results have been obtained from spinels made of Ba, Ca, Mg, and Zn with alumina. It is believed that the cost of preparing these spinels will be less than half the present price of tin oxide.

A GRANT of Rs.100,000 has been made for the development of the glass industry in India, and most of the money will be spent in installing modern furnaces. A United Provinces industrialist has been given a grant also on a subsidy basis to develop the manufacture of soda ash at Bahjoi. Sodium sulphate is already being manufactured at Bahjoi and a new plant at a cost of Rs.100,000 will be installed to convert sodium sulphate into soda ash.

THAT A LARGE PROPORTION of digitalis preparations (used in the treatment of heart disease) sold in India is below par in quality is a recent finding of the Biochemical Standardisation Laboratory, Calcutta, which since its inception nearly two years ago, has been making an all-India survey of the quality of medicinal preparations for which definite and recognised standards of comparison are available. In the interests of all concerned it seems imperative that some form of control should be exercised by the State over drugs like digitalis, says the Laboratory.

AFTER MAKING A RECORD OUTPUT of 9,241,564 short tons valued at $24,131,733 in 1937, the output of salt in the United States from domestic mines, wells, and ponds declined sharply in 1938 to 8,025,768 tons valued at $23,242,561. The million-ton drop in total salt in 1938, as revealed by U.S. Bureau of Mines figures, was accounted for almost wholly by a 936,773 ton decrease in the production of salt in brine. The output of evaporated salt was only 150,452 tons less than in the previous year, while that of rock salt declined only 128,773 tons. The chemical industries as a group were not so hard hit as other industries by the 1932 depression and they recovered faster. Heavy chemicals made from brine fared even better than other chemicals. Soda ash, for example, was aided by the tremendous growth in the glass industry, now the leading consumer of this material, and caustic soda, being used in the production of rayon, shared in the extraordinary expansion of that industry. The paper industry, another large consumer of soda ash and of caustic soda, likewise has been much more active than other industries. Seventy-nine plants (63 companies) reported operations in 1938 compared with 73 (59 companies) in 1937.

# Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

## Applications for Patents

PROCESS FOR DEWAXING HYDROCARBONS, ETC.—Aktiebolaget Separator-Nobel. (Sweden, May 17, '38.) 14728; (Sweden, Aug. 23, '38.) 14729.

CONCENTRATION OF SULPHURIC ACID.—Bamag, Ltd., and A. H. Manning. 14223.

CHEMICAL, ETC., ICE.—W. R. D. Beamish and J. H. Kogan. 14038.

EXTRACTION OF FIBROUS MATERIALS with solvents.—C. T. Bowring and Co. (Fish Oils), Ltd., and F. Lawson. 14324.

CAST-IRON ALLOYS.—British Cast Iron Research Association, British and Dominions Ferralloy, Ltd., and J. W. Bampfylde. 14193.

MANUFACTURE OF CELLULOSE DERIVATIVES.—British Celanese, Ltd. (United States, May 13, '38.) 14221.

MANUFACTURE OF A DERIVATIVE OF *p*-AMINO-BENZENE SULPHONAMIDE.—British Drug Houses, Ltd., and F. H. Carr. 14101.

MANUFACTURE OF ORGANIC COMPOUNDS.—British Industrial Plastics, Ltd., and A. Brookes. 14102.

MANUFACTURE OF MANGANESE DIOXIDE.—British Thomson-Houston Co., Ltd. (Tokyo Electric Co., Ltd.) 14615.

MANUFACTURE OF PIGMENTS.—Cornbrook Chemical Co., Ltd., and J. K. Barraclough. 14350.

PRODUCTION OF ARTIFICIAL MATERIALS.—H. Dreyfus. 14610.

PROCESS FOR SOLVENT EXTRACTION.—E. I. du Pont de Nemours and Co. (United States, May 13, '38.) 14500.

COATING, ETC., COMPOSITIONS.—E. I. du Pont de Nemours and Co. (United States, May 20, '38.) 14767.

ALLOY STEEL, ETC.—Electro Metallurgical Co. (United States, May 21, '38.) 14390.

MANUFACTURE OF SULPHUR-CONTAINING ORGANIC COMPOUNDS.—S. Ellingworth, F. L. Rose, and Imperial Chemical Industries, Ltd. 14768.

MANUFACTURE OF MONOAZO DYESTUFFS.—W. W. Groves (I. G. Farbenindustrie.) 14212.

MANUFACTURE OF PURIFIED VITAMIN E PREPARATIONS.—W. W. Groves (I. G. Farbenindustrie.) 14738.

DYEING OF VAT DYESTUFFS.—W. R. E. Hopkins, S. T. McQueen, C. S. Woolvin, and Imperial Chemical Industries, Ltd. 14635.

MANUFACTURE, ETC., OF MONOAZO DYESTUFFS.—G. F. Howard, A. H. Knight, and Imperial Chemical Industries, Ltd. 14497.

MANUFACTURE OF ANILIDES.—G. F. Howard, A. H. Knight, and Imperial Chemical Industries, Ltd. 14769.

MANUFACTURE OF DIPHENYLSULPHONE DERIVATIVES.—I. G. Farbenindustrie. (Germany, May 20, '38.) 14097.

MANUFACTURE OF THIOFORMAMIDE COMPOUNDS.—I. G. Farbenindustrie. (Germany, May 12, '38.) 14099.

MANUFACTURE OF DIPHENYLSULPHONE DERIVATIVES.—I. G. Farbenindustrie. (Germany, Dec. 2, '38.) (Cognate with 14097.) 14098.

## Complete Specifications Open to Public Inspection

METAL FABRICATING-OILS.—Standard Oil Development Co. Nov. 12, 1937. 24412/38.

CYCLIC SUBSTITUTED DICHLORINATED ALIPHATIC HYDROCARBONS and processes of preparing the same.—Armour and Co. Nov. 12, 1937 25484/38.

VINYL-TYPE RESINS.—Armour and Co. Nov. 12, 1937. 25485/38.

CATALYTIC PROCESS for vapour-phase reactions.—Standard Oil Development Co. Nov. 13, 1937. 28379/38.

PROCESS FOR SMELTING ACID ORES.—Kohle-und Eisenforschung Ges. Nov. 9, 1937. 28529/38.

PROCESS FOR SMELTING ACID ORES.—Kohle-und Eisenforschung Ges. Nov. 15, 1937. 28833-4/38.

PROCESS FOR THE REMOVAL OF MERCAPTANS from mercaptide solutions.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Nov. 15, 1937. 30542/38.

METHOD AND APPARATUS FOR INJECTION-MOULDING VINYL RESINS. Carbide and Carbon Chemicals Corporation. Nov. 11, 1937. 31031/38.

SOLID REACTIONS.—E. I. du Pont de Nemours and Co. Nov. 9, 1937. 31200/38.

PROCESS AND MEANS FOR PURIFYING WATER.—Eau et Assainissement Anciens Etablissements C. Gibault. Nov. 13, 1937. 31272/38.

TREATMENT OF CASTOR OIL for the purpose of obtaining therefrom a product having the siccative properties and resistance to water and carbonates possessed by wood (tung) oil.—P. Rizzi. Nov. 12, 1937. 31799/38.

CASEIN COLD PROCESS.—K. Ripper. Nov. 13, 1937. 32133/38.

MANUFACTURE OF UNSYMMETRICAL TRIMETHINE DYESTUFFS.—I. G. Farbenindustrie. Nov. 9, 1937. 32222/38.

MANUFACTURE OF SATURATED AND UNSATURATED COMPOUNDS of the bis-nor-cholanic acid and aetic-cholanic acid series and substitution products.—Soc. of Chemical Industry in Basle. Nov. 9, 1937. 32224/38.

MANUFACTURE OF CARBONYL COMPOUNDS OF STEROIDS.—Soc. of Chemical Industry in Basle. Nov. 12, 1937. 32378/38.

MANUFACTURE OF SYMMETRICAL CARBOCYANINE DYESTUFFS.—I. G. Farbenindustrie. Nov. 10, 1937. 32683/38.

MANUFACTURE OF SYNTHETIC RUBBER-LIKE MATERIALS.—I. G. Farbenindustrie. Nov. 11, 1937. 32760/38.

PROCESS FOR THE TREATMENT OF SURFACES consisting of aluminium or aluminium alloys.—Compagnie de Produits Chimiques et Electrometallurgiques Alais, Froges, et Camarque. Nov. 15, 1937. 32849/38.

MANUFACTURE OF MONOAZO DYESTUFFS.—J. R. Geigy, A.-G. Nov. 13, 1937. 32858/38.

MANUFACTURE OF HIGH-MOLECULAR POLYMERISATION PRODUCTS.—I. G. Farbenindustrie. Nov. 12, 1937. 32979/38.

PROCESS FOR REDUCING THE WATER-RETAINING POWER OF CELLULOSE PRODUCTS.—Vereinigte Glanzstoff-Fabriken, A.-G. Nov. 12, 1937. 33103/38.

## Specifications Accepted with Date of Application

OBTAINING BERYLLIUM and beryllium alloys.—Seri Holding Soc. Anon. Dec. 19, 1936. 505,508.

MANUFACTURE OF SYNTHETIC RESINS.—E. I. du Pont de Nemours and Co., and G. D. Graves. Aug. 5, 1937. (Samples furnished.) 505,354.

RECOVERY OF TIN FROM ORES.—U. C. Tainton. Sept. 1, 1937. 505,279.

MANUFACTURE OF VINYLMETHYL KETONE.—W. W. Groves (I. G. Farbenindustrie.) Nov. 8, 1937. 505,559.

MANUFACTURE OF TRIARYLMETHANE DYESTUFFS.—W. W. Groves (I. G. Farbenindustrie.) Nov. 8, 1937. 505,560.

DESTRUCTIVE HYDROGENATION or pressure extraction of solid carbonaceous substances.—G. W. Johnson (I. G. Farbenindustrie.) Nov. 8, 1937. 505,496.

CONVERSION OF HYDROCARBON OILS into motor fuels by treatment at elevated temperatures.—Houdry Process Corporation. Nov. 20, 1936. 505,368.

PRODUCTION OF LIQUID POLYMERS from hydrocarbon gases containing olefines.—Houdry Process Corporation. Nov. 23, 1936. 505,369.

MANUFACTURE OF TRIPHENYLMETHANE DYESTUFFS.—W. W. Groves (I. G. Farbenindustrie.) Nov. 9, 1937. 505,371.

EXTRACTING DILUTE ORGANIC ACIDS.—Deutsche Gold und Silber Scheideanstalt Vorm. Roessler. Nov. 10, 1936. 505,445.

MANUFACTURE OF COMPOUNDS containing acylated amino- or imino groups.—Soc. of Chemical Industry in Basle. Nov. 11, 1936. 505,504.

ROASTING OR ROASTING AND SMELTING OF MATERIALS containing sulphide of iron.—T. R. Haglund. Nov. 12, 1936. 505,631.

METHOD OF TRANSPOSING 1 : 2-DICHLOROBUTENE-(3).—W. W. Groves (I. G. Farbenindustrie.) Nov. 12, 1937. 505,573.

MANUFACTURE AND PRODUCTION OF TWISTS from organic thermoplastic materials.—G. W. Johnson (I. G. Farbenindustrie.) Nov. 12, 1937. 505,450.

MOULDABLE COMPOSITIONS containing synthetic resins.—Bakelite, Ltd. Nov. 19, 1936. 505,578.

VACUUM DISTILLATION.—J. W. Phipps, and British Drug Houses, Ltd. Nov. 12, 1937. 505,580.

ANTHRAQUINONE VAT DYESTUFFS.—E. I. du Pont de Nemours and Co., and J. Deinet. Nov. 12, 1937. 505,584.

COMPOSITIONS containing cellulose derivatives.—Celluloid Corporation. Nov. 19, 1936. 505,599.

MANUFACTURE OF HYDROGENATION PRODUCTS of furfurol.—Deutsche Hydrierwerke, A.-G. Nov. 14, 1936. 505,600.

VAT DYESTUFFS.—E. I. du Pont de Nemours and Co. Dec. 7, 1936. 505,611.

MIXING OF SOLID CARBONACEOUS SUBSTANCES and liquid substances.—I. G. Farbenindustrie. Feb. 6, 1937. 505,294.

MAGNESIUM ALLOYS.—F. Christen. Dec. 30, 1937. 505,456.

PREPARATION OF AROMATIC AMINES containing a sulphonamide group in the aromatic ring, and derivatives thereof.—Chinoin Gyogyszer es Vegyeszeti Termekek Gyara R. T. (Dr. Kereszty and Dr. Wolf). Dec. 1, 1937. 505,312.

PRODUCTION OF METAL PHOSPHATES.—F. P. Kerschbaum. May 21, 1937. 505,321.

MANUFACTURE OF COPPER ACETOARSENITE.—Chemische Fabrik Von J. E. Devrient, A.-G. June 30, 1937. 505,465.

MANUFACTURE OF DYESTUFFS of the anthraquinone series.—I. G. Farbenindustrie. Nov. 16, 1937. (Samples furnished.) 505,546.

PROCESS FOR THE MANUFACTURE OF DERIVATIVES OF STEROLS.—Schering, A.-G. March 5, 1937. 505,552.

PRODUCTION OF IRON OXIDE PIGMENTS.—I. G. Farbenindustrie. March 25, 1938. 505,425.

OBTAINING BERYLLIUM and beryllium alloys.—Seri Holding Soc. Anon. April 29, 1937. 505,616.

LEAD ALLOYS.—H. G. C. Fairweather (Compagnie Generale d'Electricite). July 27, 1938. 505,555.

# Weekly Prices of British Chemical Products

CONDITIONS in the general chemical market have followed an even trend during the past week and the volume of inquiry for new business is about normal for the period. There is evidence that those items usually enjoying a day-to-day call are now being called for in more substantial quantities. With lower values ruling for the mercury metal an expected reduction in the quotations for mercury products is reported; the reduction of 3d. per lb. came into operation on May 19. The price position generally is steady, there being no other important changes in general chemicals, rubber chemicals and wood distillation products. In the coal tar section there is still room for improvement. A slight expansion in the volume of spot business is reported and the price position on the whole is steady with a firm undertone.

**Price Changes**

**Rises:** Benzol, crude (Manchester); Creosote (Manchester); Toluol, 90%.

**Falls:** Copper Sulphate (Manchester and Glasgow); Mercury Products; Cresylic Acid, pale 99/100% (Manchester); Pitch, medium, soft.

MANCHESTER.—The general price position on the Manchester chemical market during the past week has been steady and except in one or two instances values show little indication of giving way. Specifications for contract deliveries are covering fair quantities on the whole, although there is still room for improvement, particularly with regard to textile dyeing and finishing products. Additional new contracts covering supplies over the next few months have been reported this week in the alkali and other heavy products, and a number of orders for spot lots of miscellaneous chemicals have also been booked. The light tar products are meeting with a moderate demand, and quotations are maintained.

GLASGOW.—There has been an improved demand for general chemicals for home trade since our last report and also rather more inquiry for export. Prices generally continue very firm at about previous figures, though copper products are rather easier in sympathy with the metal market.

## General Chemicals

ACETONE.—£39 to £43 per ton, according to quantity.

ACETIC ACID.—Tech., 80%, £30 5s. per ton; pure 80%, £32 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. MANCHESTER: 80%, commercial, £30 5s.; tech., glacial, £42 to £46.

ALUM.—Loose lump, £8 7s. 6d. per ton d/d; GLASGOW: Ground, £10 7s. 6d. per ton; lump, £9 17s. 6d.

ALUMINIUM SULPHATE.—£7 5s. 0d. per ton d/d Lancs.

AMMONIA, ANHYDROUS.—Spot, 1s. to 1s. 1d. per lb. d/d in cylinders.

AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks.

AMMONIUM CHLORIDE (see Salammoniac).—Firsts, lump, spot, £42 17s. 6d. per ton; d/d address in barrels. Dog-tooth crystals, £35 per ton; fine white crystals, £18 per ton, in casks, ex store. GLASGOW: Large crystals, in casks, £37 10s.

AMMONIUM DICHROMATE.—8¼d. per lb. d/d U.K.

ANTIMONY OXIDE.—£68 per ton.

ARSENIC.—Continental material £11 per ton c.i.f., U.K. ports; Cornish White, £12 5s. to £12 10s. per ton f.o.r., mines, according to quantity. MANCHESTER: White powdered Cornish, £15 10s. per ton, ex store.

BARIUM CHLORIDE.—£11 10s. to £12 10s. per ton in casks ex store. GLASGOW: £12 per ton.

BLEACHING POWDER.—Spot, 35/37%, £9 5s. per ton in casks, special terms for contract. GLASGOW: £9 5s. per ton net ex store.

BORAX COMMERCIAL.—Granulated, £16 per ton; crystal, £17; powdered, £17 10s.; extra finely powdered, £18 10s., packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Granulated, £16 per ton in 1-cwt. bags carriage paid.

BORIC ACID.—Commercial granulated, £28 10s. per ton; crystal, £29 10s.; powdered, £30 10s.; extra finely powdered, £32 10s. in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Crystals, £29 10s.; powdered, £30 10s. 1-cwt. bags in 1-ton lots.

CALCIUM BISULPHITE.—£6 10s. per ton f.o.r. London.

CALCIUM CHLORIDE.—GLASGOW: 70/75% solid, £5 12s. 6d. per ton ex store.

CHARCOAL, LUMP.—£6 to £6 10s. per ton, ex wharf. Granulated, £7 to £9 per ton according to grade and locality.

CHLORINE, LIQUID.—£18 15s. per ton, seller's tank wagons, carriage paid to buyer's sidings; £19 5s. per ton, d/d in 16/17 cwt. drums (3-drum lots); £19 10s. per ton d/d in 10-cwt. drums (4-drum lots); 4⅝d. per lb. d/d station in single 70-lb. cylinders.

CHROMETAN.—Crystals, 2⅝d. per lb.; liquor, £13 per ton d/d station in drums.

CHROMIC ACID.—9d. per lb., less 2½%; d/d U.K.

CHROMIC OXIDE.—11½d. per lb.; d/d U.K.

CITRIC ACID.—1s. 0¼d. per lb. MANCHESTER: 1s. 0¼d. GLASGOW: B.P. crystals, 1s. 0¼d. per lb; less 5%, ex store.

COPPER SULPHATE.—£18 5s. per ton, less 2% in casks. MANCHESTER: £18 12s. 6d. per ton f.o.b. GLASGOW: £19 5s. per ton, less 5%, Liverpool in casks.

CREAM OF TARTAR.—100%, £4 12s. per cwt., less 2½%. GLASGOW: 99%, £4 12s. per cwt. in 5-cwt. casks.

FORMALDEHYDE.—£20-£22 per ton.

FORMIC ACID.—85%, in carboys, ton lots, £42 to £47 per ton.

GLYCERINE.—Chemically pure, double distilled, 1,260 s.g., in tins, £3 10s. to £4 10s. per cwt. according to quantity; in drums, £3 2s. 6d. to £3 16s. 0d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

HYDROCHLORIC ACID.—Spot, 5s. 6d. to 8s. carboy d/d according to purity, strength and locality.

IODINE.—Resublimed B.P., 6s. 9d. per lb. in 7 lb. lots.

LACTIC ACID.—(Not less than ton lots). Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50%, by vol., £41. One ton lots ex works, barrels free.

LEAD ACETATE.—LONDON: White, £31 10s. ton lots; brown, £35. MANCHESTER: White, £31; brown, £30. GLASGOW: White crystals, £29 10s.; brown, £1 per ton less.

LEAD NITRATE.—£32 per ton for 1-ton lots.

LEAD, RED.—£30 15s. 0d. 10 cwt. to 1 ton, less 2½% carriage paid. GLASGOW: £30 per ton, less 2¼% carriage paid for 2-ton lots.

LITHARGE.—GLASGOW: Ground, £30 per ton, less 2½%, carriage paid for 2-ton lots.

MAGNESITE.—Calcined, in bags, ex works, about £8 per ton.

MAGNESIUM CHLORIDE.—Solid (ex wharf) £5 10s. per ton. GLASGOW: £7 5s. per ton.

MAGNESIUM SULPHATE.—Commercial, £5 10s. per ton, ex wharf.

MERCURY PRODUCTS.—Ammoniated B.P. (white precip.), lump, 6s. 5d. per lb.; powder B.P., 6s. 7d.; bichloride B.P. (corros. sub.), 5s. 8d.; powder B.P., 5s. 4d.; chloride B.P. (calomel), 6s. 5d.; red oxide cryst. (red precip.), 7s. 6d.; levig, 6s. 9d.; yellow oxide B.P. 6s. 10d.; persulphate white B.P.C., 6s. 7d.; sulphide black (hvd. sulph cum. sulph. 50%), 6s. 6d. For quantities under 112 lb., 1d. extra; under 28 lb., 5d. extra.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities.

NITRIC ACID.—Spot, £25 to £30 per ton according to strength, quantity and destination.

OXALIC ACID.—£48 15s. to £57 10s. per ton, according to packages and position. MANCHESTER: £49 to £55 per ton ex store. GLASGOW: £2 9s. per cwt. in casks.

PARAFFIN WAX.—GLASGOW: 3¾d. per lb.

POTASH, CAUSTIC.—Solid, £33 5s. to £38 per ton according to quantity, ex store; broken, £40 per ton. MANCHESTER: £38.

POTASSIUM CHLORATE.—£36 7s. 6d. per ton. MANCHESTER: £37 per ton. GLASGOW: 4¼d. per lb.

POTASSIUM DICHROMATE.—5¼d. per lb. carriage paid. GLASGOW: 5¼d. per lb., net, carriage paid.

POTASSIUM IODIDE.—B.P. 6s. 3d. per lb. in 7 lb. lots.

POTASSIUM NITRATE.—Small granular crystals, £24 to £27 per ton ex store, according to quantity.

POTASSIUM PERMANGANATE.—LONDON: 9¼d. to 10¼d. per lb. MANCHESTER: B.P. 9¼d. to 11¼d. GLASGOW: B.P. Crystals, 10¼d.

POTASSIUM PRUSSIATE.—5¼d. to 6d. per lb. MANCHESTER: Yellow, 6d. to 6¼d.

PRUSSIATE OF POTASH CRYSTALS.—In casks, 6¾d. per lb. net, ex store.

SALT CAKE.—Unground, spot, £3 8s. 6d. per ton.

SODA ASH.—Light 98/100%, £5 17s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £13 10s. per ton d/d station.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£19-£20 per ton carriage paid North. GLASGOW: £18 10s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags in 1-ton lots. MANCHESTER: £10 15s. GLASGOW: £13 5s. per ton in 1 cwt. kegs, £11 5s. per ton in 2-cwt. bags.

SODIUM BISULPHITE POWDER.—60/62%, £12 10s. to £14 per ton d/d in 2-ton lots for home trade.

SODIUM CARBONATE MONOHYDRATE.—£20 per ton d/d in minimum ton lots in 2 cwt. free bags.
SODIUM CHLORATE.—£27 10s. to £32 per ton. GLASGOW: £1 11s. per cwt., minimum 3 cwt. lots.
SODIUM DICHROMATE.—Crystals cake and powder 4½d. per lb. net d/d U.K. with rebates for contracts. GLASGOW: 4¼d. per lb., carriage paid.
SODIUM CHROMATE.—4½d. per lb. d/d U.K.
SODIUM HYPOSULPHITE.—Pea crystals, £15 5s. per ton for 2-ton lots; commercial, £11 5s. per ton. MANCHESTER: Commercial, £11; photographic, £15 10s.
SODIUM METASILICATE.—£14 5s. per ton, d/d U.K. in cwt. bags.
SODIUM NITRATE.—Refined, £8 per ton for 6-ton lots d/d. GLASGOW: £1 12s. per cwt. in 1-cwt. kegs, net, ex store.
SODIUM NITRITE.—£18 5s. per ton for ton lots.
SODIUM PERBORATE.—10%, £4 per cwt. d/d in 1-cwt. drums.
SODIUM PHOSPHATE.—Di-sodium, £12 per ton delivered for ton lots. Tri-sodium, £16 10s. per ton delivered per ton lots.
SODIUM PRUSSIATE.—4d. per lb. for ton lots. MANCHESTER: 4¼d. to 5d. GLASGOW: 4d.
SODIUM SILICATE.—£8 2s. 6d. per ton.
SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.
SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 to £3 10s. per ton d/d station in bulk. MANCHESTER: £3 10s.
SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 15s. per ton d/d in drums; crystals, 30/32%, £9 per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8 10s.
SODIUM SULPHITE.—Pea crystals, spot, £14 10s. per ton d/d station in kegs.
SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.
SULPHURIC ACID.—168° Tw., £4 11s. to £5 1s. per ton; 140° Tw., arsenic-free, £3 to £3 10s.; 140° Tw., arsenious, £2 10s.
TARTARIC ACID.— 1s. 1¼d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 1s. 1¼d. per lb. GLASGOW: 1s 1¼d. per lb., 5%, ex store.
ZINC SULPHATE.—Tech., £11 10s. f.o.r., in 2-cwt. bags.

## Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 7d. to 1s. 2d. per lb., according to quality. Crimson, 1s. 6d. to 1s. 7½d. per lb.
ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.
BARYTES.—£6 to £6 10s. per ton, according to quality.
CADMIUM SULPHIDE.—3s. 0d. to 3s. 3d. per lb.
CARBON BLACK.—3⅞d. to 4 1/16d. per lb., ex store.
CARBON DISULPHIDE.—£31 to £33 per ton, according to quantity, drums extra.
CARBON TETRACHLORIDE.—£41 to £46 per ton, according to quantity, drums extra.
CHROMIUM OXIDE.—Green, 10½d. to 11½d. per lb.
DIPHENYLGUANIDINE.—2s. 2d. per lb.
INDIA-RUBBER SUBSTITUTES.—White, 4½d. to 5d. per lb.; dark 3⅝d. to 4⅜d. per lb.
LAMP BLACK.—£24 to £26 per ton del., according to quantity. Vegetable black, £35 per ton upwards.
LEAD HYPOSULPHITE.—9d. per lb.
LITHOPONE.—Spot, 30%, £16 10s. per ton, 2-ton lots d/d in bags.
SULPHUR.—£9 to £9 5s. per ton. SULPHUR PRECIP. B.P., £55 to £60 per ton. SULPHUR PRECIP. COMM., £50 to £55 per ton.
SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quantity.
VERMILION.—Pale, or deep, 5s. per lb., 1-cwt. lots.
ZINC SULPHIDE.—£58 to £60 per ton in casks ex store, smaller quantities up to 1s. per lb.

## Nitrogen Fertilisers

AMMONIUM SULPHATE.—The following prices have been announced for neutral quality basis 20.6% nitrogen, in 6-ton lots delivered farmer's nearest station up to June 30, 1939; November, £7 8s.; December, £7 9s. 6d.; January, 1939; £7 11s.; February, £7 12s. 6d.; March/June, £7 14s.
CALCIUM CYANAMIDE.—The following prices are for delivery in 5-ton lots, carriage paid to any railway station in Great Britain up to June 30, 1939; November, £7 12s. 6d.; December, £7 13s. 9d.; January, 1939, £7 15s.; February, £7 16s. 3d;. March, £7 17s. 6d.; April/June, £7 18s. 9d.
NITRO CHALK.—£7 10s. 6d. per ton up to June 30, 1939.
SODIUM NITRATE.—£8 per ton for delivery up to June 30, 1939.
CONCENTRATED COMPLETE FERTILISERS.—£11 4s. to £11 13s. per ton in 6-ton lots to farmer's nearest station.
AMMONIUM PHOSPHATE FERTILISERS.—£10 19s. 6d. to £14 16s. 6d. per ton in 6-ton lots to farmer's nearest station.

## Coal Tar Products

BENZOL.—At works, crude, 9½d. to 10d. per gal.; standard motor, 1s. 3½d. to 1s. 4d.; 90%, 1s. 4½d. to 1s. 5d., pure 1s. 8½d. to 1s 9d. MANCHESTER: Crude, 11½d. per gal.; pure, 1s. 8d. to 1s. 8½d. per gal.
CARBOLIC ACID.—Crystals, 6⅝d. to 7⅛d. per lb., small quantities would be dearer; Crude, 60's, 1s. 6d. to 1s. 9d.; dehydrated, 2s. 6d. per gal., according to specification; Pale, 99/100%, per lb. f.o.b. in drums; crude, 2s. 1d. per gal.
CREOSOTE.—Home trade, 3¾d. to 4d. per gal., f.o.r., makers' works; exports 6d. to 6¼d. per gal., according to grade. MANCHESTER: 3¼d. to 4¼d.
CRESYLIC ACID.—97/99%, 1s. 3d. to 1s. 6d.; 99/100%, 1s. 9d. to 2s. 6d. per gal., according to specifications; Pale, 99/100%, 1s. 5d. to 1s. 7d.; Dark, 95%, 1s. 2d. to 1s. 3d. per gal. MANCHESTER: Pale, 99/100%, 1s. 7d.
NAPHTHA.—Solvent, 90/160, 1s. 6d. to 1s. 7d. per gal.; solvent, 95/160%, 1s. 7d. to 1s. 8d., naked at works; heavy 90/190%, 1s. 1½d. to 1s. 3d. per gal., naked at works, according to quantity. MANCHESTER: 90/160%, 1s. 5d. to 1s. 7d. per gal.
NAPHTHALENE.—Crude, whizzed or hot pressed, £4 10s. to £5 10s. per ton; purified crystals, £9 10s. per ton in 2-cwt. bags. LONDON: Fire lighter quality, £3 to £4 10s. per ton. MANCHESTER: Refined, £10 10s. to £12 per ton f.o.b.
PITCH.—Medium, soft, 26s. per ton, f.o.b. MANCHESTER: 26s. f.o.b., East Coast.
PYRIDINE.—90/140%, 12s. 6d. to 14s. per gal.; 90/160%, 10s. 6d. to 11s. 6d. per gal.; 90/180%, 3s. to 4s. per gal. f.o.b. MANCHESTER: 10s. 6d. to 14s. per gallon.
TOLUOL.—90%, 2s. 1d. to 2s. 2d. per gal.; pure 2s. 5d. to 2s. 6d. MANCHESTER: Pure, 2s. 4d. per gallon, naked.
XYLOL.—Commercial, 2s. 3d. per gal.; pure, 2s. 5d. MANCHESTER: 2s. 4d. per gallon.

## Wood Distillation Products

CALCIUM ACETATE.—Brown, £6 15s. to £9 5s. per ton; grey, £8 to £8 5s. MANCHESTER: Brown, £8; grey, £9 10s.
METHYL ACETONE.—40.50%, £32 to £35 per ton.
WOOD CREOSOTE.—Unrefined, 6d. to 8d. per gal., according to boiling range.
WOOD NAPHTHA, MISCIBLE.— 2s. 8d. to 3s per gal;. solvent, 3s. to 3s. 5d. per gal.
WOOD TAR.—£3 to £8 per ton, according to quality.

## Intermediates and Dyes

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZIDINE, HCl.—2s. 7½d. per lb., 100% as base, in casks.
BENZOIC ACID, 1914 B.P. (ex toluol).— 1s. 11½d. per lb. d/d buyer's works.
*m*-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.
*o*-CRESOL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.
*p*-CRESOL 34/35° C.— 1s. 7d. to 1s. 8d. per lb. in ton lots
DICHLORANILINE.—2s. 1½d. to 2s. 5½d. per lb.
DIMETHYLANILINE.—Spot, 1s. 7½d. per lb., package extra.
DINITROBENZENE.—7½d. per lb.
DINITROCHLORBENZENE, SOLID.—£79 5s. per ton.
DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 11d
DIPHENYLAMINE.—Spot, 2s. 2d. per lb.; d/d buyer's works.
GAMMA ACID, Spot, 4s. 4½d. per lb. 100%, d/d buyer's works.
H ACID.—Spot, 2s. 7d. per lb.; 100%, d/d buyer's works.
NAPHTHIONIC ACID.—1s. 10d. per lb.
β-NAPHTHOL.—£97 per ton; flake, £94 8s. per ton.
α-NAPHTHYLAMINE.—Lumps, 1s. 1d. per lb.
β-NAPHTHYLAMINE.—Spot 3s. per lb.; d/d buyer's works.
NEVILLE AND WINTHER'S ACID.—Spot, 3s. 3½d. per lb. 100%.
*o*-NITRANILINE.—4s. 3½d. per lb.
*m*-NITRANILINE.—Spot, 2s. 10d. per lb. d/d buyer's works.
*p*-NITRANILINE.—Spot, 1s. 10d. to 1s. 11d. per lb. d/d buyer's works.
NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.
NITRONAPHTHALENE.—9½d. per lb.; P.G., 1s. 0½d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 11d. per lb.; 100% d/d buyer's works.
SULPHANILIC ACID.—Spot, 8⅜d. per lb. 100%, d/d buyer's works.
*o*-TOLUIDINE.—10½d. per lb., in 8/10 cwt. drums, drums extra.
*p*-TOLUIDINE.—1s. 10½d. per lb., in casks.
*m*-XYLIDINE ACETATE.—4s. 3d. per lb., 100%.

## Latest Oil Prices

LONDON, May 24.—LINSEED OIL was steady. Spot, £27 5s. per ton (small quantities); June, July-Aug., Sept.-Dec., and Jan.-April, £24 15s., sellers. SOYA BEAN OIL was quiet. Oriental, June-July shipment, c.i.f. bulk, £18 5s. per ton. RAPE OIL was quiet. Crude, extracted, £31 10s. per ton; technical refined, £32 15s., naked, ex wharf. COTTON OIL was quiet. Egyptian crude, £18 per ton; refined common edible, £22 10s.; deodorised, £24 10s., naked, ex mill (small lots £1 10s. extra). TURPENTINE was steady. American, spot, 33s. 6d.; and June, 33s. per cwt.

HULL.—LINSEED OIL.—Spot, £25 2s. 6d. per ton; May, £24 12s. 6d.; June-Aug. and Sept.-Dec., £24 15s. COTTON OIL.—Egyptian, crude, spot, £18 per ton; edible, refined, spot, £21; technical, spot, £21; deodorised, £23, naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £18 10s. per ton, naked. GROUNDNUT OIL.—Extracted, spot, £23 per ton; deodorised £26. RAPE OIL.—Extracted, spot, £30 10s. per ton; refined, £31 10s. SOYA OIL.—Extracted spot, £25 per ton; deodorised, £28. COD OIL.—F.o.r. or f.a.s., 25s. per cwt. in barrels. CASTOR OIL.—Pharmaceutical, 39s. 6d. per cwt.; first, 34s. 6d.; second, 32s. 6d. TURPENTINE.—American, spot, 35s. 6d. per cwt.

# Commercial Intelligence

**The following are taken from printed reports, but we cannot be responsible for errors that may occur.**

## Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

GENERAL REFRACTORIES, LTD., Sheffield. (M., 27/5/39.) April 27, £800 mortgage, to British General Insurance Co., Ltd.; charged on The Gables, Deepcar, near Sheffield. * £80,000. June 9, 1938.

JETGLAZE, LTD., London, N.W., lacquer manufacturers. (M., 27/5/39.) May 11, debenture to Trade Distributors, Ltd., securing all moneys now or at any time owing by the company to the holder; general charge. * Nil. May 2, 1938.

SOLIDOL CHEMICAL, LTD., London, S.E. (M., 27/5/39.) May 15, mortgage, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Ashmead Works, Disney Street, Southwark. * Nil. Jan. 6, 1939.

# Company News

**The American Enka Corporation** report a net profit for 1938 of £1,020,000 (£2,518,000).

**Fison, Packard and Prentice, Ltd.,** have declared an interim dividend of 2½ per cent. (the same).

**Dussek Brothers & Co., Ltd.,** have declared an interim dividend of 4 per cent., less tax (3 per cent.), payable on June 12.

**United Molasses, Ltd.,** are maintaining their interim dividend for 1938-39 at 7½ per cent., less tax. The interim dividend a year ago was followed by a final dividend of 15 per cent.

**Craig and Rose, Ltd.,** paint manufacturers, report a profit for the year to March 31, of £8,261 (£10,532). A dividend of 4 per cent. (5 per cent.) free of tax, has been declared and £8,495 (£9,234) is carried forward.

**Stevenson and Howell, Ltd.,** report profits for 1938 of £41,261 (£47,426). A final dividend of 9 per cent., free of tax, making 14 per cent. (17 per cent.) has been declared. The carry forward is £59,423 (£97,479).

**A. B. Fleming & Co., Ltd.,** manufacturers of dry colours, etc., report a profit of £78,998 (£78,065), including £24,564 (£21,173) brought in. A final dividend of 10 per cent., less tax, making 15 per cent. (same) has been declared with a bonus of 2 per cent. (same).

**British Alkaloids, Ltd.,** report that profits for the year to March 31 last increased from £55,410 to £62,132. The amount written off advertising expenditure is raised £4,000 to £22,000, and £11,200 against £11,900 is reserved for tax and N.D.C., which leaves net profits up from £25,510 to £28,932. The ordinary dividend for the year is raised by 3 per cent., to 45 per cent., less tax, and 26.71 per cent. compared with 25.19 per cent. is being paid on the 8 per cent. participating preference shares. General reserve receives £4,500, against £2,500 and £4,395 goes forward, subject to the directors' additional remuneration.

# Chemical Trade Inquiries

**The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).**

**Belgium.**—An agent established at Antwerp wishes to obtain the representation of United Kingdom manufacturers of anti-corrosive paints, enamels (particularly fireproof for stoves), waterproofing compounds for roofs for Belgium. (Ref. No. 425.)

**Egypt.**—The Commercial Secretary to H.M. Embassy at Cairo reports that the Egyptian Ministry of Agriculture is calling for tenders for the supply and delivery of quantities of sprayers, dusters and chemicals required for crop protection. The requirements include sulphur, sodium arsenate, zinc phosphide, etc. Tenders should be addressed to the Administration of Stores and Purchases, Dokki, where they will be received up to 11 a.m. on June 29,1939. (Ref. T. 22800/39.)

**Canada.**—A firm of agents established at Montreal wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of drugs for the Province of Quebec and the Maritimes. (Ref. No. 406.)

**Belgium.**—A well-established firm of agents at Brussels wishes to obtain the representation of United Kingdom manufacturers of solvents, diluents, dissolvents, plasticisers, pigments, micronised ores, synthetic resins, glycollic ethers and their acetates, linseed oil, wood oil, castor oil, for Belgium. (Ref. No. 426.)

**British East Africa—Kenya and Uganda.**—The Crown Agents for the Colonies, acting on behalf of the Kenya and Uganda Railways and Harbours Administration, are prepared to receive quotations for the supply of a minimum of 4,000 tons and a maximum of 60,000 tons of fuel oil of standard quality for the purpose of the lake steamers, locomotives, etc., for a period of three years from September 21, 1939. An alternative quotation may be given for the supply for one year only. Quotations should be submitted not later than May 31, and are to remain open until June 24.

# Chemical and Allied Stocks and Shares

THE new Stock Exchange account which began on Monday has so far not brought any material increase of business to the stock and share markets, but the majority of movements in industrial and kindred shares were again to higher levels. Sentiment was assisted by the more hopeful views current in regard to the international political situation and also by the excellent impression created by the important company results published recently.

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Securities of companies associated with the chemical and kindred trades reflected the general market trend. Fison Packard and Prentice continued to attract rather more attention, and the price has further improved from 39s. to 40s. The maintenance of the company's interim dividend was in accordance with market expectations as the assumption was that all question of an increased payment would be left until the final dividend. British Plaster Board continued active in response to current dividend estimates, and at 29s. are 1s. higher on the week, while Reckitt and Sons' ordinary shares more than held the rally which followed the annual meeting. Turner and Newall advanced from 76s. 6d. to 78s. 9d., while British Aluminium were steady at 57s. 6d., and Murex rose to 78s. 9d. British Oxygen were also 78s. 9d., and Lever and Unilever at 35s. 6d. were fairly well maintained.

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Imperial Chemical were firm at 30s. 4½d., while the preference units at 30s. 7½d. were also around the same price as that ruling a week ago. The market is taking the view that there seem reasonable prospects of the dividend being maintained on an 8 per cent. basis, despite the indication given by the statements at the recent meeting that it is the intention to continue to place large sums to the various reserve funds. B. Laporte were lowered from 88s. 9d. to 85s., but the price is now "ex" the recently-declared dividend. Staveley Coal and Iron at 42s. 9d. have more than held last week's rally, as have Stanton Iron at 42s. 9d., while various other shares of companies with colliery and allied interests also attracted more attention owing to reports of improving conditions in the coal trade.

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Stewarts and Lloyds have risen further from 42s. 9d. to 44s., and Tube Investments are 88s. 9d. compared with 87s. 6d. a week ago. Baldwins were well maintained, while higher prices have ruled for Guest Keen and Nettlefolds and Whitehead Iron and Steel. The results of the two last-named companies are due shortly. Richard Thomas shares and debentures were active, but were little changed on balance, the tendency being to await the annual report and meeting which are expected next month. Ruston and Hornsby were higher on the increased distribution for the past year, which exceeded market expectations.

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Associated Cement were little changed at 71s. 10½d., and most other shares of cement manufacturers were also around the same prices as those ruling a week ago. Wall Paper Manufacturers' deferred units were lowered from 27s. 6d. to 26s. 10½d., but are "ex" the interim dividend. Pinchin Johnson, International Paint and a number of other paint shares were better, while British Match remained firm at 32s. 6d. Barry and Staines improved 1s. to 33s., and Michael Nairn held their recent rise to 55s. 7½d.

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Boots Drug were slightly higher at 41s. 9d., and Sangers kept at 20s. 6d., while British Drug Houses continued to be quoted at around 21s. Timothy Whites and Taylors, now "ex" the dividend, have been lowered to 22s. 6d., but Beechams Pills deferred shares rose further from 8s. 4½d. to 9s. 1½d. British Oil and Cake Mills preferred ordinary shares were 41s. 3d., compared with 40s. 6d. a week ago. Leading oil shares were more active, partly owing to the good impression created by the dividend of the V.O.C. Company, and higher prices ruled for "Shell," Anglo-Iranian and Burmah Oil.